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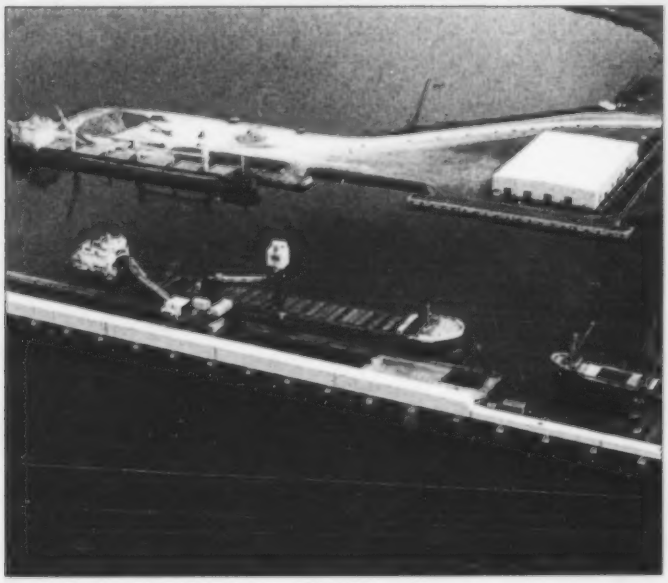
Mineral Resource Report

TIDEWATER EXPORT OPPORTUNITIES FOR BEDROCK AGGREGATE IN NORTHERN NEW BRUNSWICK



T.C. Webb

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TIDEWATER EXPORT OPPORTUNITIES FOR BEDROCK AGGREGATE IN NORTHERN NEW BRUNSWICK

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Cover illustration: *Aerial view of the Port of Belledune, northern New Brunswick, Canada.*

Photograph courtesy of the Belledune Port Authority.

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ABSTRACT

Several factors favour the potential development of a bedrock aggregate export operation near the deep-water Port of Belledune in northern New Brunswick. Millions of tonnes of accessible aggregate resources lie very near the Port. Mafic volcanic and plutonic rocks around Belledune already provide high-quality aggregate that has been used for more than two decades to produce construction materials for local markets. The year-round Port is strategically situated on Canada's east coast near major aggregate markets in the United States. Port facilities have sufficient storage and loadout capabilities to handle a wide range of ocean-going vessels. As well, the industrial infrastructure in the Belledune region features many support services and is enhanced by a workforce experienced in mining and related resource sectors. The Port of Belledune has the potential to become a major international supplier of high-quality crushed stone and related construction products for the eastern seaboard and Gulf coast of North America, and for Europe.

RÉSUMÉ

Des millions de tonnes de ressources d'agrégats du substrat rocheux accessibles se trouvent très près du port moderne en eau profonde, en activité à longueur d'année, de Belledune, dans le Nord-Est du Nouveau-Brunswick. Le port est stratégiquement situé sur la côte est du Canada, près des grands marchés d'agrégats des États-Unis, et pourrait devenir l'un des principaux fournisseurs internationaux de roche concassée de haute qualité et de produits de construction connexes le long du littoral est de l'Amérique du Nord, sur la côte du golfe du Mexique et ailleurs. Les roches volcanomafiques et plutoniques de la région de Belledune constituent des sources prouvées d'agrégats de qualité répondant à la demande locale et régionale de toute une variété de matériaux de construction depuis près de deux décennies. Le port dispose d'une capacité de stockage et d'installations de chargement suffisantes pour accueillir un vaste éventail de navires océaniques. L'infrastructure industrielle de soutien, qui bénéficie d'une main-d'oeuvre expérimentée dans l'extraction minière et les secteurs connexes des ressources, est considérée comme un atout précieux pour l'implantation d'une entreprise d'exportation d'agrégats prospère dans le Nord du Nouveau-Brunswick.

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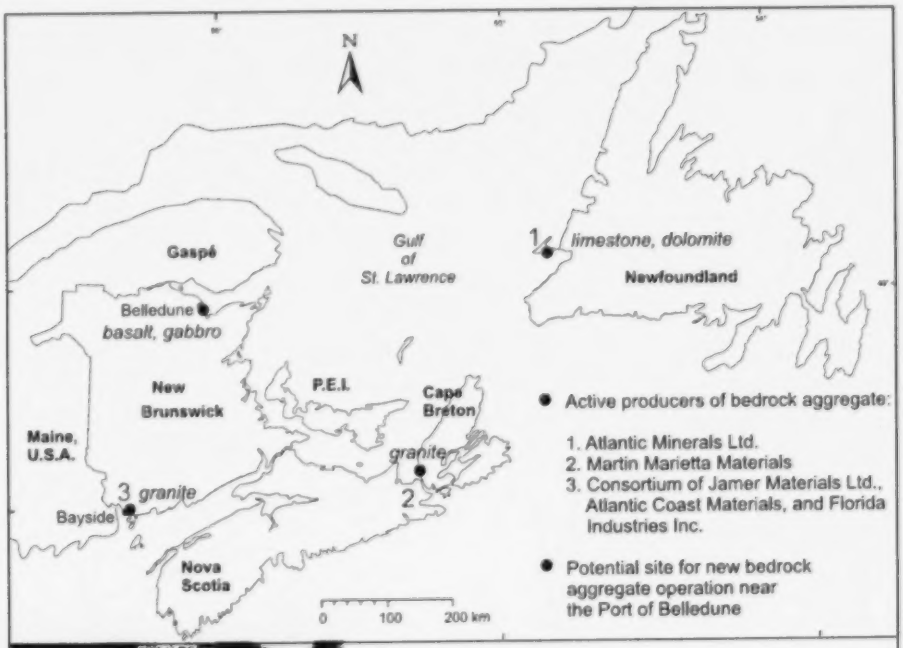
METRIC AND IMPERIAL EQUIVALENTS

1 centimetre (cm) = .393 inches
1 metre (m) = 3.281 feet
1 kilometre (km) = 0.621 miles
1 hectare (ha) = 2.471 acres
1 square kilometre (km^2) = 0.386 square miles
1 metric tonne (tonne) = 1102 short tons

INTRODUCTION

Demand for high-quality construction aggregate from tidewater locations in Atlantic Canada has been increasing since the early 1990s. Each of the Atlantic Provinces (except Prince Edward Island) has at least one bedrock aggregate operation situated at or near tidewater (Fig. 1).

Several potential sources of bedrock aggregate at tidewater also exist throughout the region. One of the most promising sites occurs in northern New Brunswick near the modern, deep-water Port of Belledune (Fig. 1). This report summarizes the geology of high-grade bedrock aggregate materials in the Belledune area and gives detailed engineering test data supporting the rock's suitability to produce coarse aggregate for construction projects. The report also describes how the Port of Belledune and its surrounding industrial infrastructure offer many advantages favouring the successful establishment of a new bedrock aggregate operation in the region — one strategically placed to serve export markets in eastern North America and Europe.



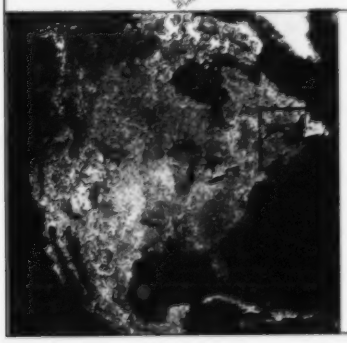


Figure 1. Location of active tidewater aggregate producers in Atlantic Canada. Potential site for new bedrock aggregate operations is shown near the Port of Belledune, northern New Brunswick. The Port is situated at latitude 47° 55' 00" north and longitude -65° 50' 00" west. Area of figure is outlined in red on location map to the left.

Establishment of a new aggregate operation in Atlantic Canada will depend directly on the need for high-quality construction materials in large metropolitan areas along the eastern seaboard and Gulf coast of the United States, as well as in parts of the Caribbean Islands. The aggregate industry in the eastern United States currently is affected by 1) resource depletion and sterilization, 2) stringent specifications for construction materials, and 3) high transportation and distribution costs. These combined factors are causing aggregate suppliers in the eastern United States to consider the importation of processed material as a cost-effective alternative to using domestic sources. As a result, the export demand for aggregate materials from Atlantic Canada is anticipated to increase.

Favourable locations for tidewater aggregate operations generally are restricted to remote or industrialized settings that feature an extensive, high-quality bedrock source situated at or very near an established port facility. The port must have sufficient infrastructure and capabilities to accommodate the efficient loading of 30 000 tonne to 40 000 tonne vessels (see p. iii for Metric–Imperial equivalents). Locations meeting these criteria are fairly few on the eastern coast of North America. In New Brunswick, the best example is a major crushed stone operation in an industrial park at Bayside on the Bay of Fundy, southwest New Brunswick (Fig. 1). The quarry and plant lie about half a kilometre from the marine terminal at the Port of Bayside. The operation processes and ships more than 1 million tonnes of graded aggregate materials annually, and it is owned by a consortium consisting of Jamer Materials Ltd., Atlantic Coast Materials, and Florida Rock Industries Inc.

The Belledune region of northern New Brunswick on Canada's east coast also meets most criteria for the viable establishment of a tidewater aggregate enterprise. The area contains bedrock sources of high-quality aggregate materials within 10 km of the Port of Belledune (Fig. 2). The Port lies 35 km north of the City of Bathurst (Fig. 2) on Chaleur Bay, near the periphery of the Chaleur Economic Development Region. The Greater Chaleur District features sea and rail transportation links to the North American market and has an industrial infrastructure with numerous support services. As well, the local workforce is highly experienced in mining and related industries.

GEOLOGY OF THE BELLEDUNE AREA

Introduction

Within a 10 km radius of the Port of Belledune, potential source rocks for aggregate materials are restricted to a geologic terrane known as the Elmtree Inlier (Fig. 2). The Inlier covers a triangular area measuring about 100 km^2 and has a generally flat topography; elevations seldom exceed 23 m above sea level. The landscape typically features expanses of barren rock or, more commonly, sparse vegetation covering a thin layer of glacial till.

The regional drainage network consists mainly of small, northerly flowing rivers, streams and tributaries, and minor lakes. Because sizeable watercourses are few, the sites underlain

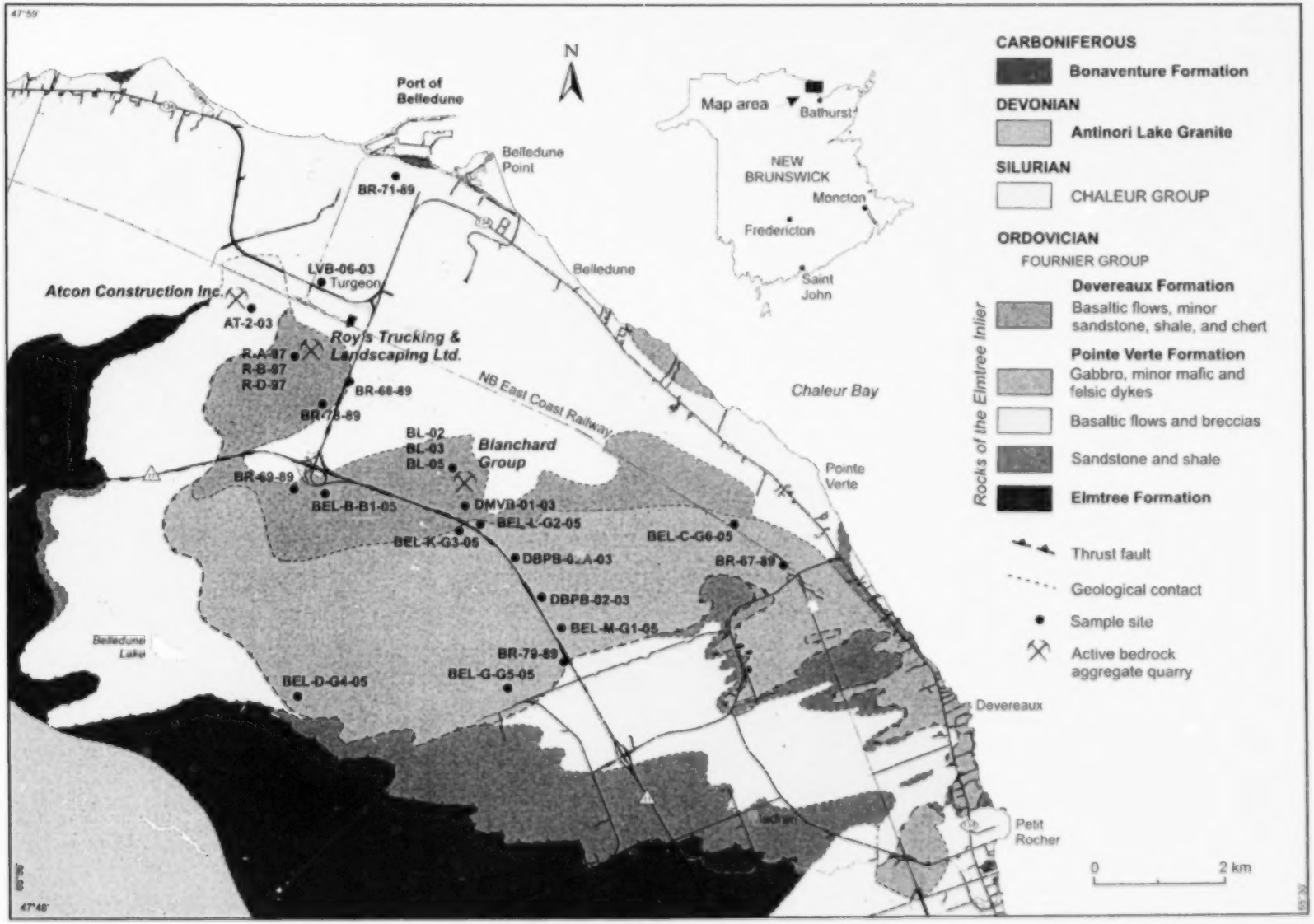
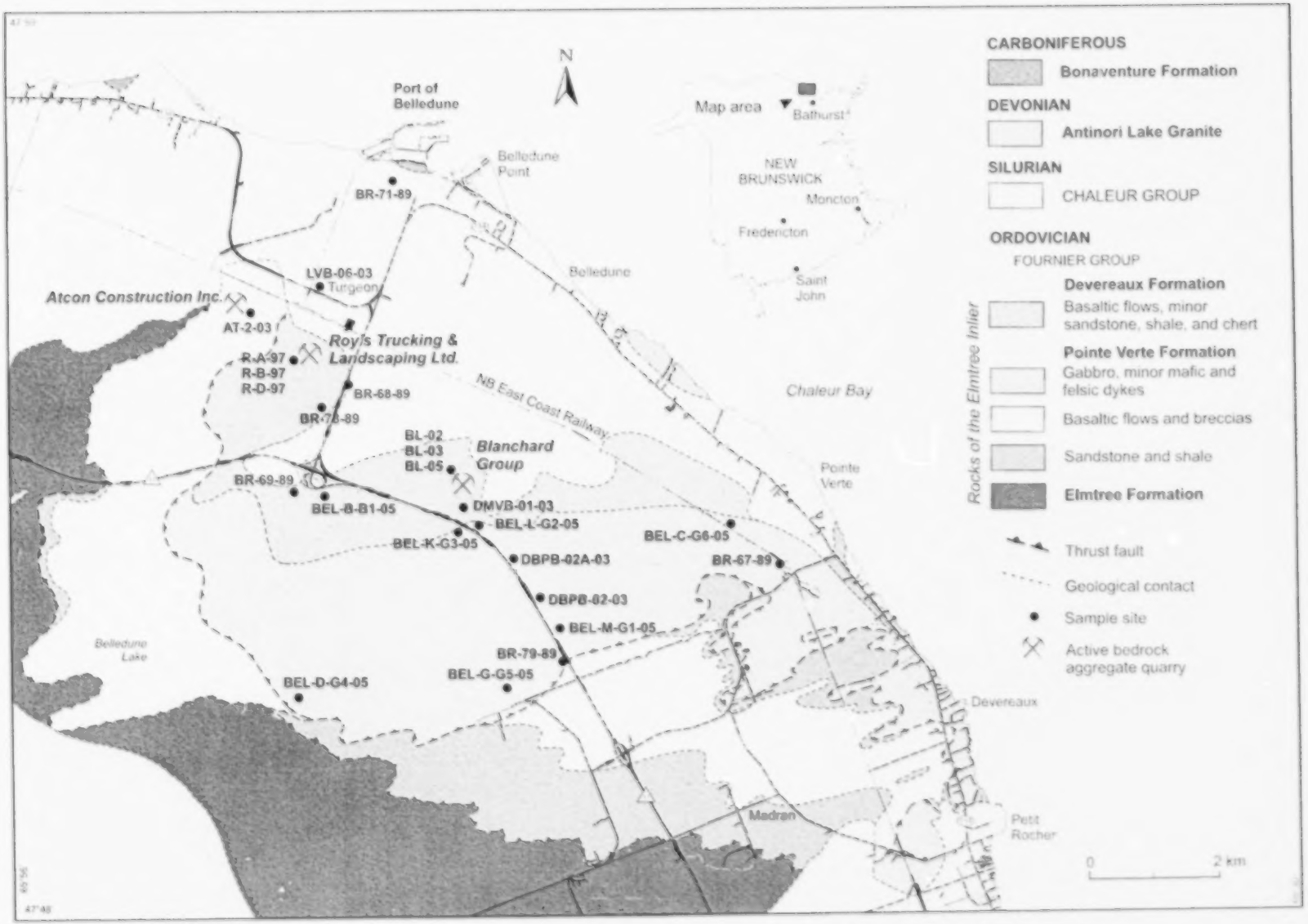


Figure 2. General geology of the Belledune area, showing rocks of the Elmtree Inlier and surrounding formations. Map also indicates location of the three active bedrock aggregate quarries.



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by aggregate resources have limited supplies of natural surface water. However, an earthen dam crosses the Belledune River a few kilometres west of the potential development area. The resulting large reservoir provides water to several heavy industrial operations in the region.

Bedrock Geology

The following lithological descriptions are summarized from Pajari et al. (1977), van Staal and Fyffe (1991), Winchester et al. (1992), Langton (1993), and Walker et. al. (2003a, b).

The Elmtree Inlier is composed of Ordovician rocks that are unconformably overlain by, and in places faulted against, Silurian rocks of the Chaleurs Group (Fig. 2). In the Belledune area, the Chaleurs Group comprises conglomerate, limestone, sandstone, and minor mafic volcanic rocks. Along the coast, the Silurian rocks are unconformably overlain by flat-lying Carboniferous red sandstone of the Bonaventure Formation (Fig. 2).

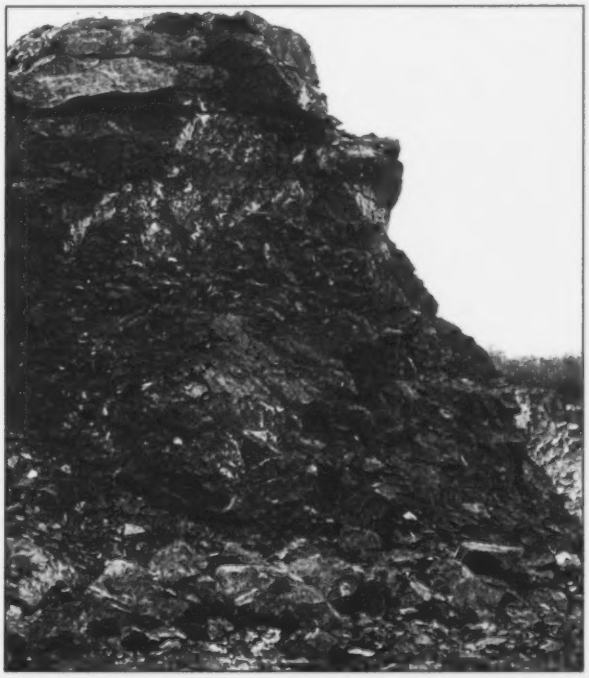


Figure 3. Pillow basalt of the Pointe Verte Formation near the Port of Belledune, northern New Brunswick.

The Elmtree Inlier is represented by Ordovician sedimentary rocks of the Elmtree Formation, and Ordovician mafic igneous rocks of the Pointe Verte (Fig. 3–6) and Devereaux formations (Fig. 7–10), both of the Fournier Group (Fig. 2). The southwestern part of the Inlier features interlayered shale and sandstone of the Elmtree Formation (Fig. 2). These sedimentary rocks have low potential as exportable aggregate materials, due to their distance from the Port of Belledune and to their poor engineering properties. Similarly, the younger, mainly sedimentary rocks of the Chaleurs Group are not considered as priority sources of high-quality aggregate.

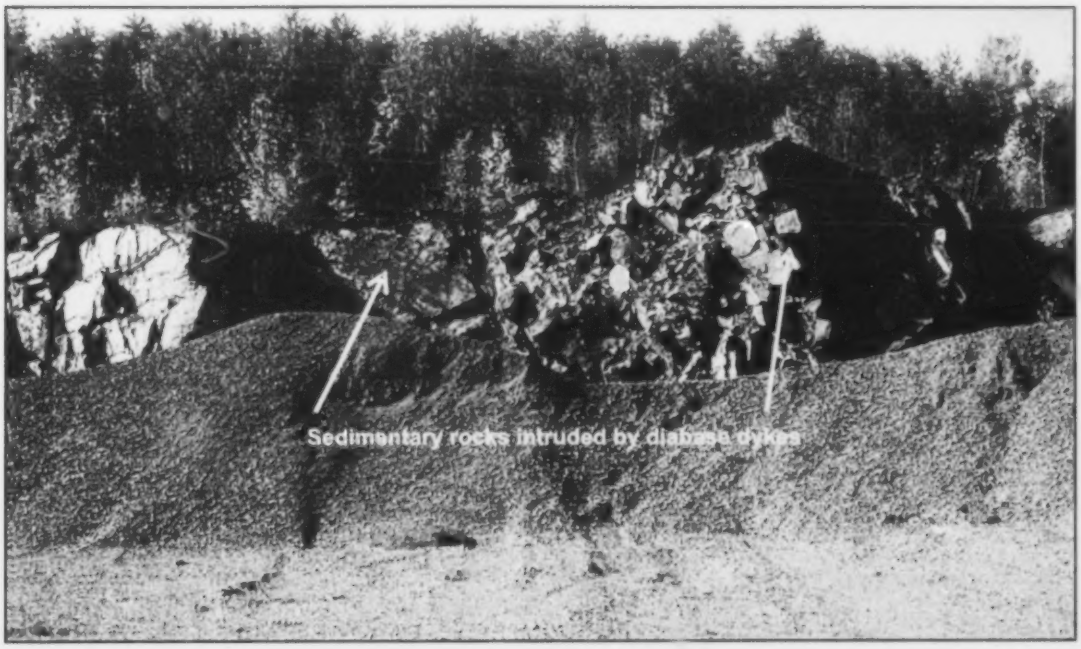


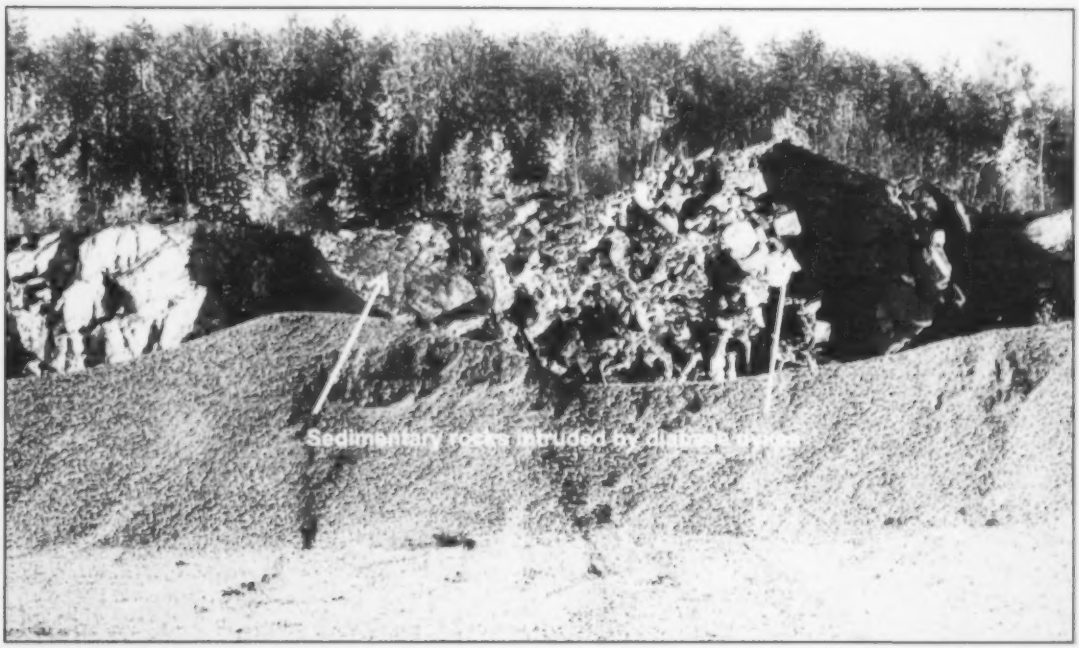
Figure 4. Mafic dyke intruding sedimentary rocks of the Pointe Verte Formation near the Port of Belledune, northern New Brunswick.

More promising for the export market are rocks of the Fournier Group. Specifically, these comprise the fine-grained mafic volcanic and medium- to coarse-grained plutonic rocks of the Devereaux Formation and, to a lesser extent, the Pointe Verte Formation. These rocks occur in the northeastern part of the Inlier (Fig. 2) and outcrop almost within sight of the Port of Belledune. As well, they already supply aggregate materials for local and regional construction projects.

Pointe Verte Formation

The Pointe Verte Formation includes pillow basalt (Fig. 3) and associated basaltic breccia (Fig. 5, 6) underlain and interlayered with minor sandstone and shale. Rocks of this formation extend from Pointe Verte on Chaleur Bay westward for 14 km to Belledune Lake and from there northeastward almost to Belledune Point, an area exceeding 35 km^2 (Fig. 2). The mafic volcanic sequence of the Point Verte Formation structurally overlies the sedimentary sequence of the Elmtree Formation and in turn is structurally overlain by mafic plutonic and volcanic rocks of the Devereaux Formation. Both lower and upper contacts of the Pointe Verte Formation are interpreted as major thrust faults, characterized by zones of high strain. Mafic dykes locally intrude tilted sedimentary rocks of the Pointe Verte Formation and likely are Silurian (Fig. 4).

Volcanic rocks of the Pointe Verte Formation have a limited history of supplying construction aggregate. A large quarry is situated in Pointe Verte rocks south of the Port of Belledune and is operated intermittently by Atcon Construction Inc. (Fig. 2).



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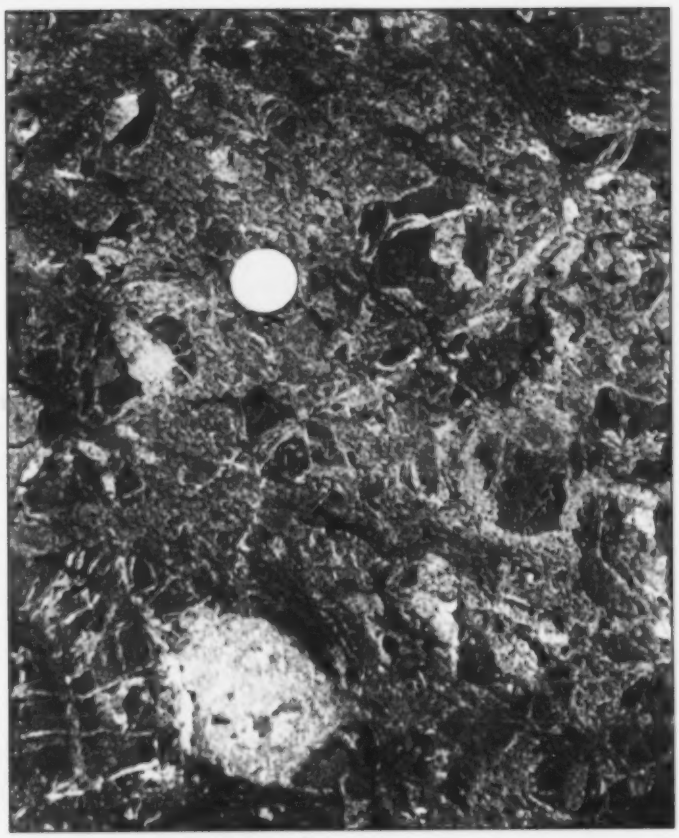


Figure 5. Basaltic breccia of the Pointe Verte Formation near the Port of Belledune, northern New Brunswick.

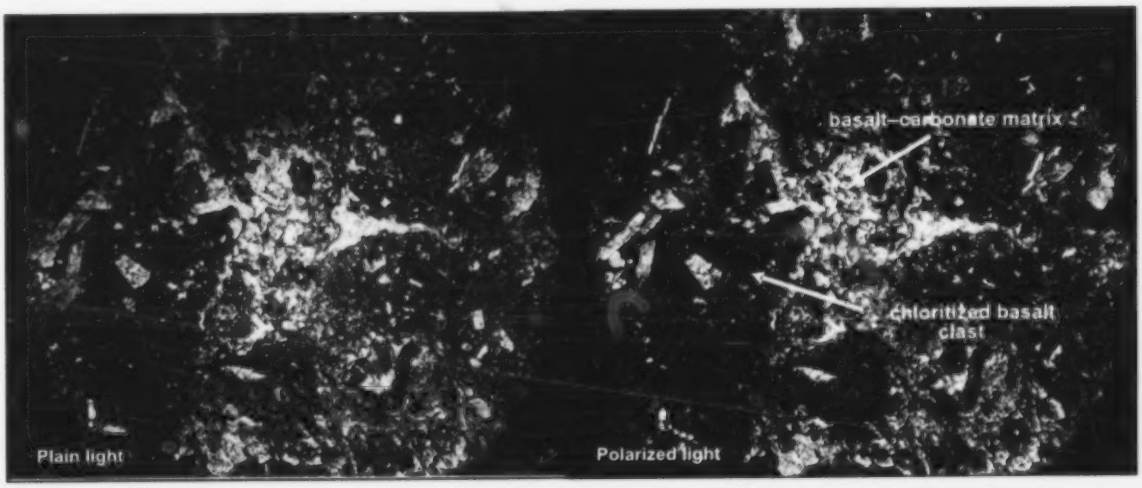


Figure 6. Photomicrographs of basaltic breccia, Pointe Verte Formation. The rock is texturally and compositionally similar to the rock shown in Figure 4. Field of view is 3.5 mm.

Figure 7. Dark green, medium- to coarse-grained gabbro of the Devereaux Formation, a few kilometres south of the Port of Belledune, northern New Brunswick. Hammer is 35 cm long.

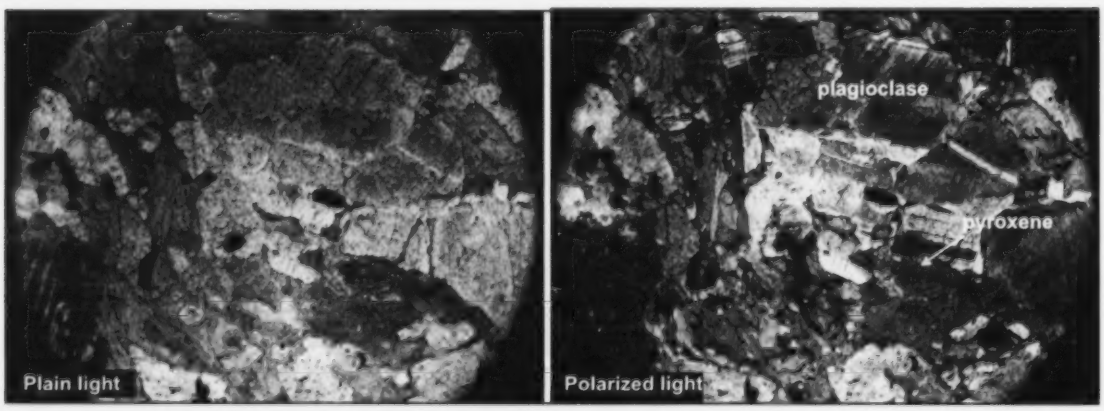


Figure 8. Photomicrograph of gabbro from the Devereaux Formation, a few kilometres south of the Port of Belledune, northern New Brunswick. Field of view is 3.5 mm.

Figure 9. Thick basaltic flows overlying gabbro of the Devereaux Formation, a few kilometres south of the Port of Belledune, northern New Brunswick. Hammer is 35 cm long.

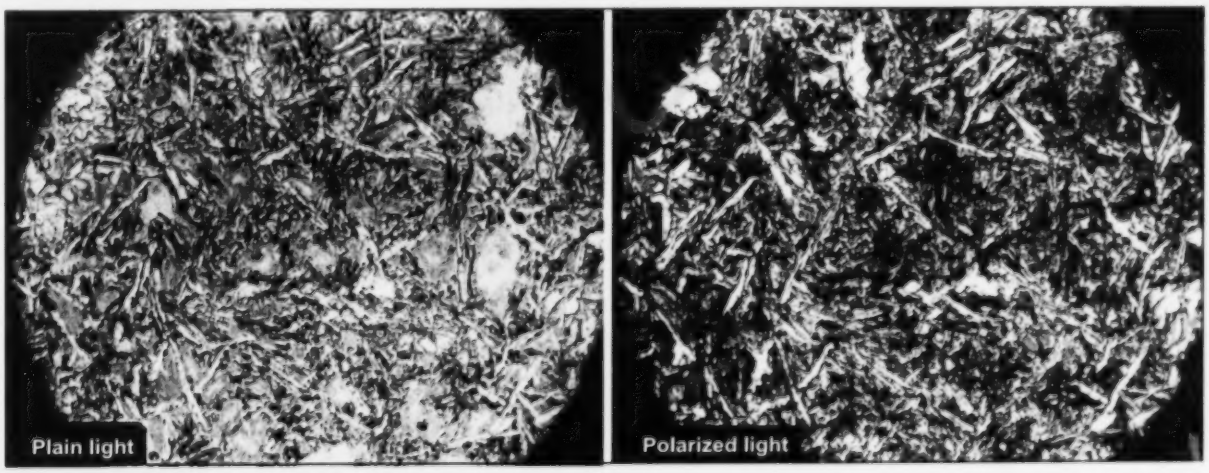


Figure 10. Photomicrographs of typical basaltic flows from the Devereaux Formation, a few kilometres south of the Port of Belledune, northern New Brunswick. Field of view is 3.5 mm.

Devereaux Formation

The Devereaux Formation comprises dark-brown to green, massive to layered, medium- to coarse-grained gabbroic rocks (Fig. 7, 8), overlain by a thick sequence of locally pillowed, fine-grained basaltic flows (Fig. 9, 10). The mafic flows are locally interbedded with minor sandstone, shale, and chert. The gabbroic and basaltic rocks are locally amphibolitized in high-strain zones and are intruded by mafic and felsic dykes. The entire sequence is considered to be an ancient fragment of obducted oceanic crust.

The Devereaux Formation extends a few kilometres north and south of Devereaux along Chaleur Bay, and reaches inland for 10 km to near Belledune Lake, covering an area of about 45 km^2 (Fig. 2). Gabbroic rocks account for roughly 70% of the formation, and basaltic flows constitute most of the remainder; the basaltic rocks typically occur north of the gabbroic sequence (Fig. 2). Total thickness of the Devereaux Formation has not been ascertained. However, a water well at the Blanchard Group quarry in Belledune was collared in Devereaux basalt and reached a depth approaching 400 m, intersecting mafic volcanic rock over its entire length (pers. comm., Ron Arseneau 2004).

Both gabbroic and basaltic rocks of the Devereaux Formation have been used extensively over decades to provide aggregate materials for local and regional construction projects. Two large quarry operations currently are active in the area underlain by predominantly basaltic rocks: one is owned by Roy's Trucking & Landscaping Ltd. and the other by the Blanchard Group. As well, a now-inactive quarry was worked briefly in gabbroic rocks of this formation at Pointe Verte.

ENGINEERING TEST RESULTS

Over the last 15 years, the New Brunswick Department of Natural Resources (NBDNR) and local aggregate producers have collected numerous bedrock samples from aggregate-suitable rocks of the Fournier Group in the Belledune area. Many samples have undergone engineering tests to evaluate their suitability as coarse aggregate for specific construction applications. Testing was conducted according to guidelines established by the Canadian Standards Association (CSA) and the American Society of Testing Materials (ASTM). Some samples also underwent whole-rock chemical analyses and preliminary petrographic analyses to correlate the mineralogy, textural contrasts, and physical properties of the material.

Appendix 1 provides data on selected samples collected by the NBDNR and local bedrock aggregate producers. Sample sites are shown on Figure 2. Data in Appendix 1 and Table 1 indicate that most basaltic and gabbroic rocks of the Devereaux Formation meet or exceed minimum CSA and ASTM requirements for many construction applications. In some cases, additional testing may be required to properly evaluate and confirm engineering, physical, and chemical properties of these bedrock resources.

Table 1. Summary of ASTM test results for potential alkali reactivity of aggregate materials from selected bedrock sources in the Belledune area, northern New Brunswick. Sample sites are shown on Figure. 2.

Sample Number	Rock Type	Expansion % *	
		14 days	28 days
BEL-B-B1-05	Basaltic breccia	0.2559	0.5169
BEL-C-G6-05	Basalt	0.1232	0.2980
BEL-D-G4-05	Gabbro	0.0782	0.1906
BEL-G-G5-05	Gabbro	0.0680	0.1531
BEL-K-G3-05	Basalt	0.1400	0.3323
BEL-L-G2-05	Gabbro	0.0041	0.0072
BEL-M-G1-05	Gabbro	0.1324	0.2214

* Expansions of < 0.10% at 16 days after casting indicate innocuous behaviour in most cases. Expansions of > 0.20% at 16 days after casting indicate potentially deleterious expansion. Expansions of between 0.10 and 0.20% at 16 days after casting include aggregates known to be innocuous and deleterious in field performance. For these aggregates, supplemental information and comparator readings are needed for a duration of 28 days (ASTM C1260-01; XI, interpretation of test results).

RESOURCE ACCESSIBILITY

Mafic volcanic and plutonic rocks of the Devereaux Formation have been mapped over about 45 km^2 within a 10 km radius of the Port of Belledune (Fig. 2). Assuming a density of 2.95 tonnes/m^3 and a hypothetical thickness of 20 m, the resource base of high-quality aggregate materials in the Belledune region potentially could approach 2 billion tonnes.

About 52% of the area underlain by potential aggregate source rock is situated on Crown land (Fig. 11). Crown land is publicly owned by the Government of New Brunswick and managed by the NBDNR. Access to Crown land aggregate is facilitated through regulatory procedures in the Quarriable Substances Act of the NBDNR (Appendix 2). The remaining 48% of the resource base occurs on freehold lands, which are owned privately either by individual landowners or by large corporations. Most freehold properties in the Belledune region consist of woodlots and/or land designated for industrial purposes. Residential

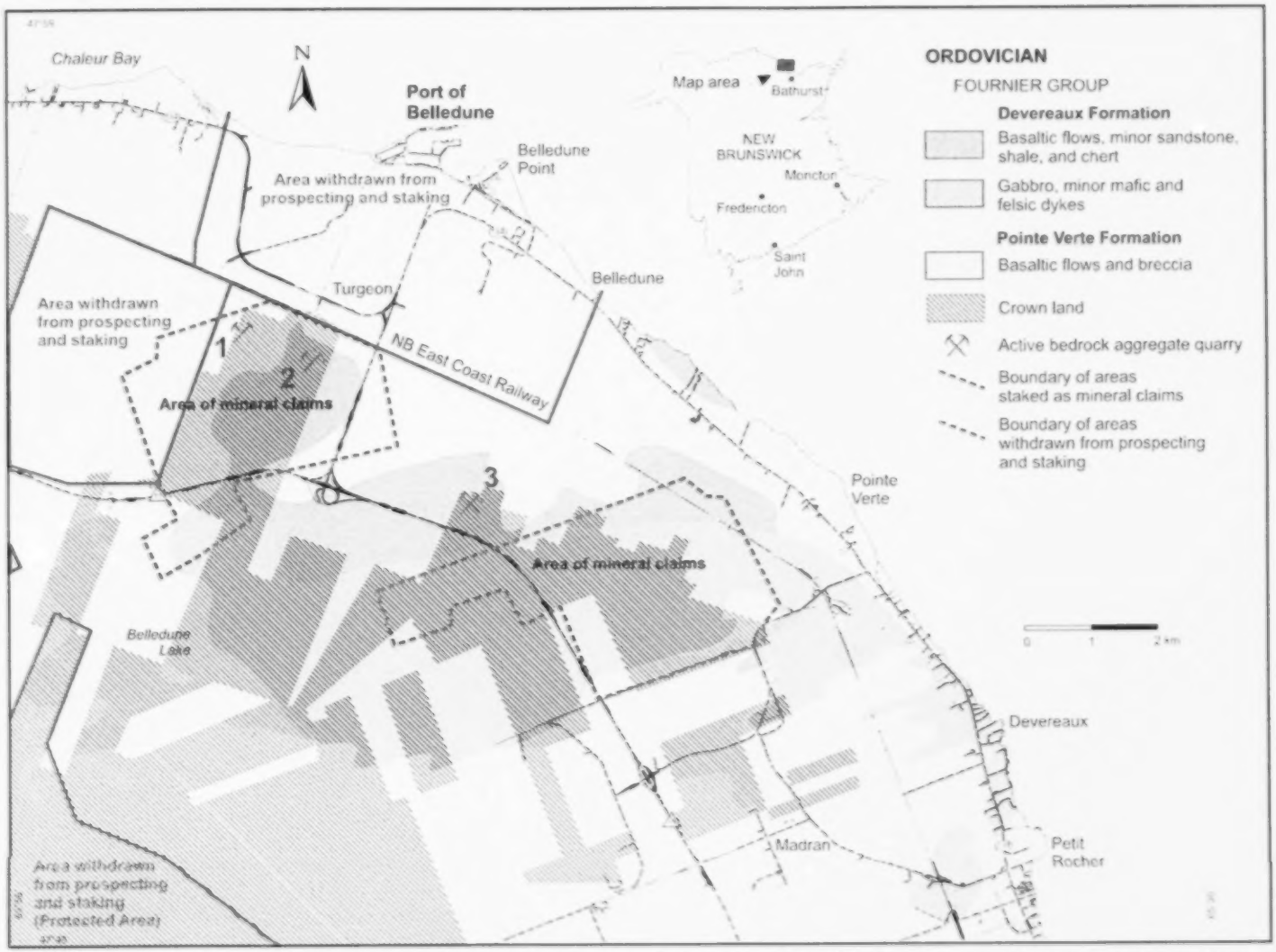
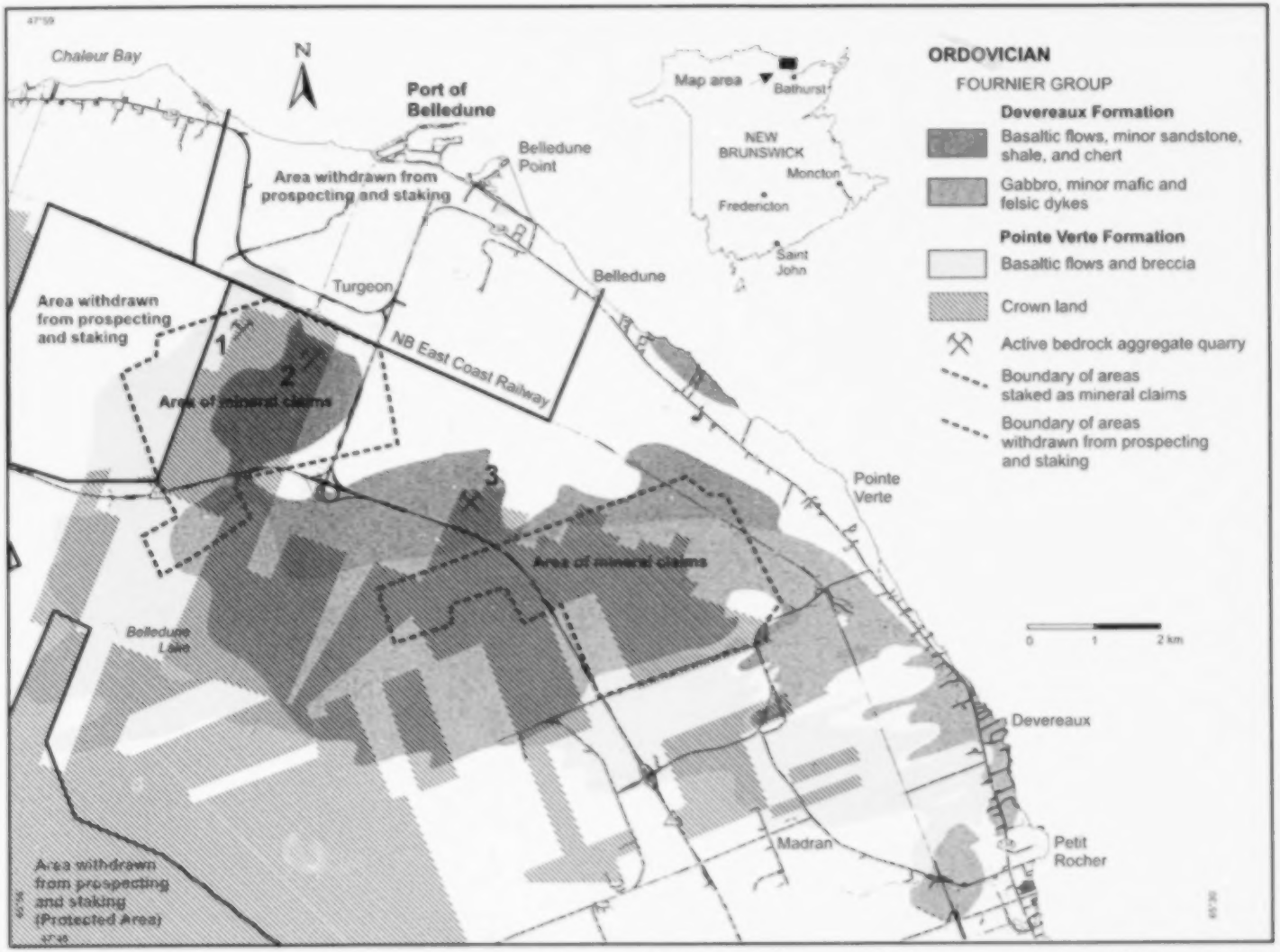


Figure 11. Map showing distribution of Crown land, mineral claim blocks, protected area, and areas withdrawn from prospecting and staking near the Port of Belledune, northern New Brunswick. Active quarries are identified by red numbers. 1 = Atcon Construction Inc. 2 = Roy's Trucking & Landscaping Ltd. 3 = Blanchard Group.



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properties occur only in the most easterly part of the district underlain by rocks of the Fournier Group (that is, rocks with the most geological potential as aggregate materials). Access to, and development of, aggregate resources in freehold areas must be negotiated with the respective landowners.

Two large mineral claim blocks have been staked in the aggregate resource area (Fig. 11), but the blocks still qualify as potential sources of construction aggregate. On Crown land, mining claims for mineral commodities beneath the surface and quarry leases for mineral commodities on the surface can be granted for the same block of land. In other words, aggregate materials on Crown land usually remain available for quarry development, even if the ground has been staked for mineral claims. The Government of New Brunswick has well established adjudicative processes to resolve disagreements between mineral claimholders and quarry leaseholders, should differences of opinion arise concerning resource development.

Land designated as protected areas, and other sites removed from mineral prospecting and staking, also occur in the Belledune region (Fig. 11). They likely will have limited impact on any potential development of aggregate resources in the district, as more than 90% of the source bedrock lies beyond such restricted zones.

Active Aggregate Suppliers

Three bedrock aggregate quarries are active within 5 km of the Port of Belledune (Fig. 2, 11). They are worked seasonally, and their output is closely tied to local and regional aggregate demand. The quarries (Fig. 12–17) are situated on Crown land (Fig. 11) and operate under the terms of quarry leases obtained from the Province of New Brunswick. All quarry leases are administered by the NBDNR.

- The *Atcon Construction Inc. quarry* was opened in 1996 under a ten-year renewable quarry lease (Quarry Lease # 33) for an area of almost 54 ha. The quarry (Fig. 12) operates intermittently, accumulating inventories of stockpiled material to satisfy local demand. Rock types in the quarried area include basaltic breccia, pillow basalt, and minor diabasic dykes and sedimentary rocks (Fig. 13).

- The *Blanchard Group quarry* is part of a 66 ha area held since 1995 under a ten-year renewable quarry lease (Quarry Lease # 32). The quarry (Fig. 14) has operated annually since its establishment, supplying various grades of crushed materials for local construction projects. Its coarse aggregate is used to produce high-quality Portland cement concrete and bituminous concrete for asphalt paving. The basaltic source rock (Fig. 15) is tested annually to verify compliance with accepted quality standards.

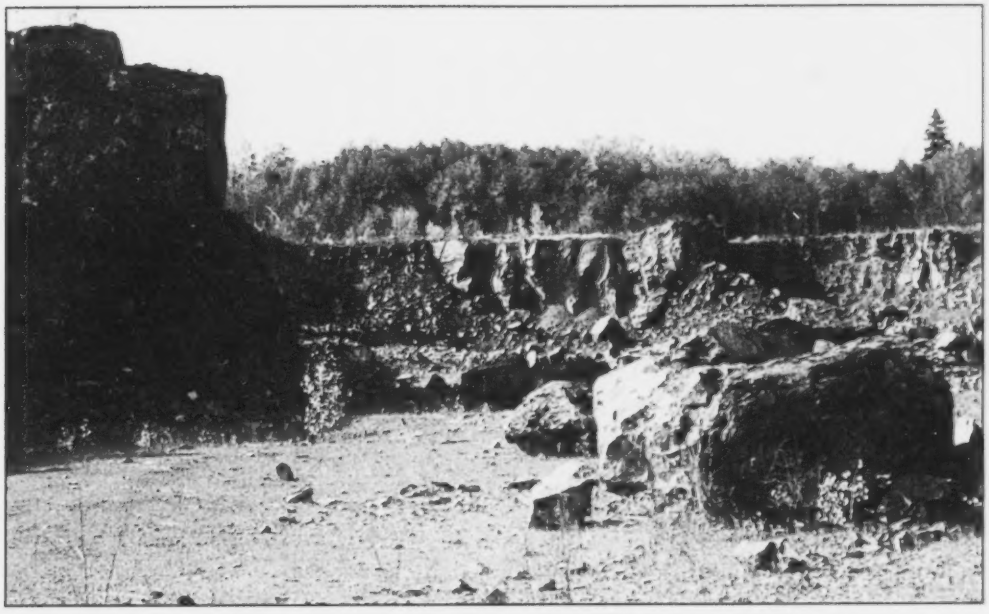


Figure 12. The Atcon Construction Inc. quarry southwest of the Port of Belledune, northern New Brunswick.

Figure 13. Processed bedrock aggregate from the Atcon Construction Inc. quarry. Pen is 13.5 cm long.

Figure 14. The Blanchard Group quarry south of the port of Belledune, northern New Brunswick.

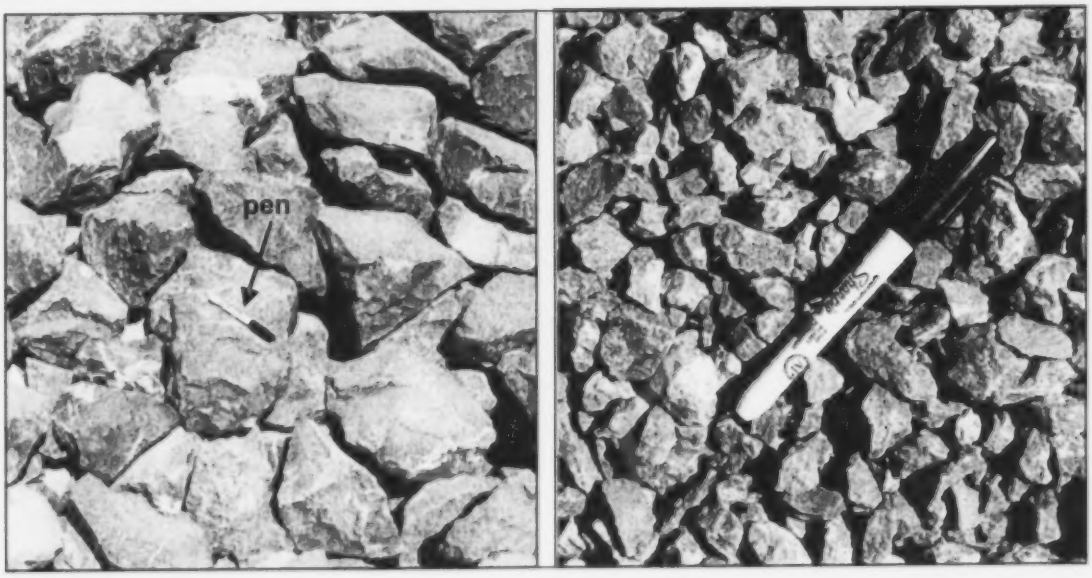


Figure 15. Processed aggregate from the Blanchard Group quarry south of the Port of Belledune. Pen is 13.5 cm long.

Figure 14. The Blanchard Group quarry south of the port of Belledune, northern New Brunswick.

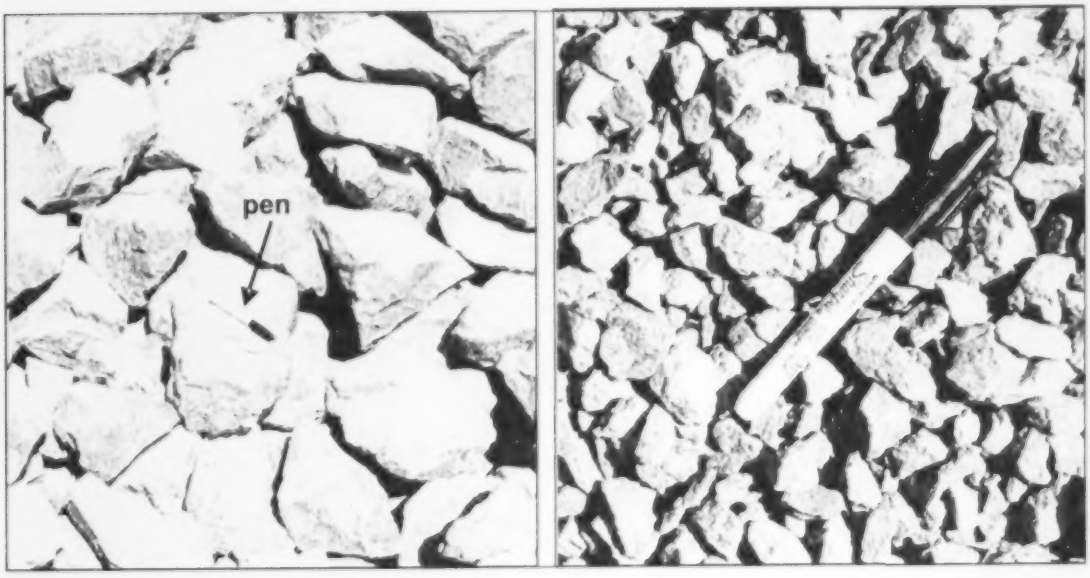


Figure 15. Processed aggregate from the Blanchard Group quarry south of the Port of Belledune. Pen is 13.5 cm long.

Figure 16. The Roy's Trucking & Landscaping Ltd. quarry south of the Port of Belledune, northern New Brunswick.

Figure 17. Processed aggregate from the Roy's Trucking & Landscaping Ltd. quarry south of the Port of Belledune, northern New Brunswick. Photograph on the left shows 3-inch-to-8- inch aggregate. Pen cap is 4 cm long.

- The *Roy's Trucking & Landscaping Ltd. quarry* is situated on 40 ha of land leased from the Province of New Brunswick (Quarry Lease # 35) and has been active since 1996. The lease agreement is renewable in 2006. The quarry (Fig. 16) supplies processed aggregate, breakwater stone, and armour stone for local and regional construction projects. The basaltic source rock (Fig. 17) has undergone various engineering tests and satisfies criteria for several different end uses.

Appendix 3 contains detailed information for interested parties wishing to contact the foregoing quarry operators regarding their potential to supply aggregate materials.

THE PORT OF BELLEDUNE

Introduction

The Port of Belledune and its surrounding industrial infrastructure are fully capable of supporting an export business aimed at providing construction aggregate to clients along the eastern seaboard and Gulf coast of North America, and in Europe. The region offers major advantages in terms of its location, climate, port facilities, transportation infrastructure, and support services.

Location

The Port of Belledune is situated on the south shore of Chaleur Bay, northern New Brunswick, on Canada's east coast near the entrance to the world-class Gulf of St. Lawrence Seaway. The Port compares favourably with other active ports in this part of Atlantic Canada. It offers year-round access to major international shipping lanes as well as proximity to strategic North American and European destinations (Table 2).

Table 2. Distances and shipping times from the Port of Belledune, northern New Brunswick, to destinations along the eastern seaboard and Gulf coast of North America, and in Europe.

By Ship from Belledune to:	Distance (miles)	Steaming Time @ 14 knots
Boston	876	2 days 15 hours
New York	1083	3 days 5 hours
Charleston	1567	4 days 16 hours
Norfolk	1264	3 days 18 hours
Miami	1891	5 days 15 hours
Galveston	2791	8 days 7 hours
New Orleans	2636	7 days 20 hours
Panama	2467	7 days 8 hours
Rotterdam	2861	8 days 12 hours
By Barge from Belledune to:	**Distance (miles)**	**Steaming Time @ 6 knots**
Boston	876	6 days 2 hours
New York	1083	7 days 13 hours
Charlottetown	224	1 days 13 hours

Source: World Ports Distance Calculator: www.distances.com (accessed 01/02/06)

Climate

Northern New Brunswick has a continental climate modified by occasional mild weather in winter and cool coastal temperatures in summer. January generally is the coldest month, reporting average maximum and minimum temperatures of –5.9°C and –12.9°C. July, the warmest month, typically registers average maximum and minimum temperatures of 22.5°C and 13.5°C. This region of New Brunswick experiences an average annual rainfall of 744 mm and an annual snowfall of 314 cm. It enjoys nearly 2000 hours of sunshine per year.

Port Development

The Port of Belledune has three main terminals: Terminal # 1, Terminal # 2, and the M.D. Young Terminal (Fig. 18–20). The federal government began constructing the Port in 1968 using armour stone and other local construction materials. The facility initially consisted of one terminal (Terminal # 1; Fig. 18) that handled inbound shipments of various petroleum products, in addition to phosphate rock and coke for a nearby smelter–fertilizer manufacturing complex. Major outbound shipments consisted of refined lead ingots, zinc, related base-metal concentrates, and sulphuric acid.

In the 1980s, a delivery terminal (Terminal # 2; Fig. 20) was installed to ship 1.2 million tonnes of coal annually to a nearby 458 MW power-generating facility owned and operated by NB Power Generation. In 1998, the M.D. Young Terminal (Fig. 18–20) was constructed to handle dry-bulk and break-bulk cargos. Inbound shipments have since expanded to include perlite, coke, and various forest products. Outbound shipments consist of gypsum, forest products, and other specialty cargoes.

Port Facilities

The M.D. Young Terminal offers the best opportunity for moving bulk aggregate materials from the Port of Belledune (Fig. 19, 20). The terminal has a wharf measuring 455 m by 100 m and water depths of up to 11.5 m. An open area adjacent to the wharf covers 13.5 ha, offers ample storage for thousands of tonnes of bulk material, and is readily accessible by road and rail.

Freight handling and storage at the terminal are the responsibility of Eastern Canada Stevedoring Inc., which provides loading and unloading services using a variety of equipment (Fig. 21, 22). A modern, moveable conveyance system ensures a maximum loading time of less than 24 hours for 30 000 tonne to 40 000 tonne vessels. The company offers a bulk-loading capability of 1500 tonnes/hour and moves several hundred thousand tonnes of cargo annually. Gypsum shipments alone exceed 225 000 tonnes per year. The company also handles armour stone and other bulk cargoes that texturally resemble aggregate material.

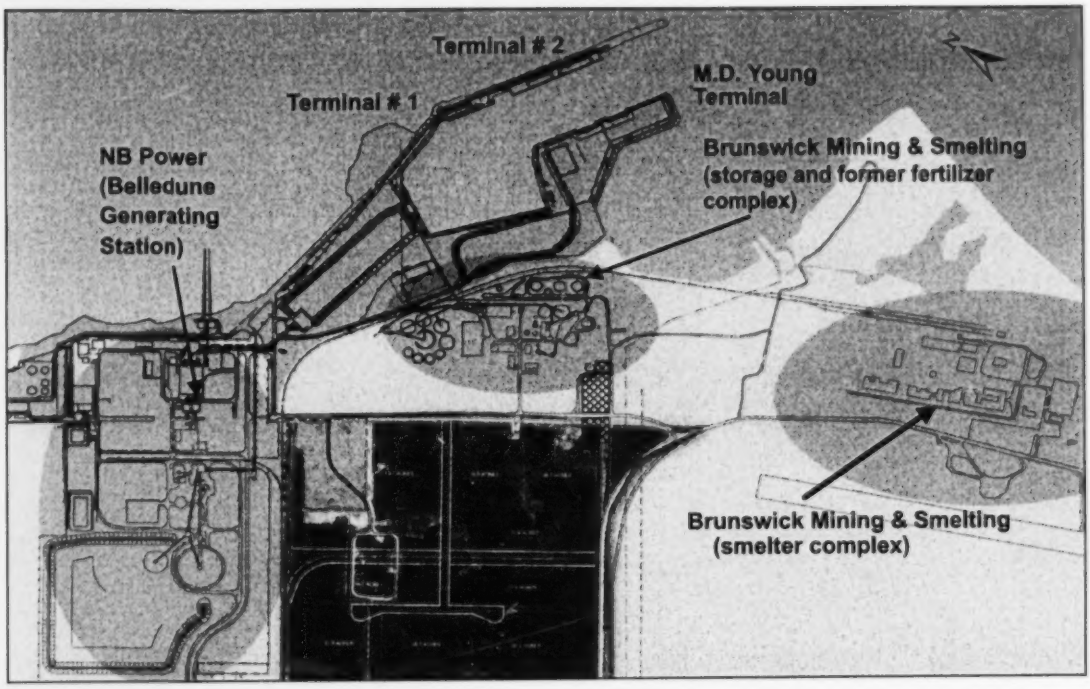

Terminal # 2
Terminal # 1
M.D. Young Terminal
N
NB Power (Belledune Generating Station)
Brunswick Mining & Smelting (storage and former fertilizer complex)
Brunswick Mining & Smelting (smelter complex)

Figure 18. Plan view of the Port of Belledune, northern New Brunswick, showing position of main terminals and long-term clients.

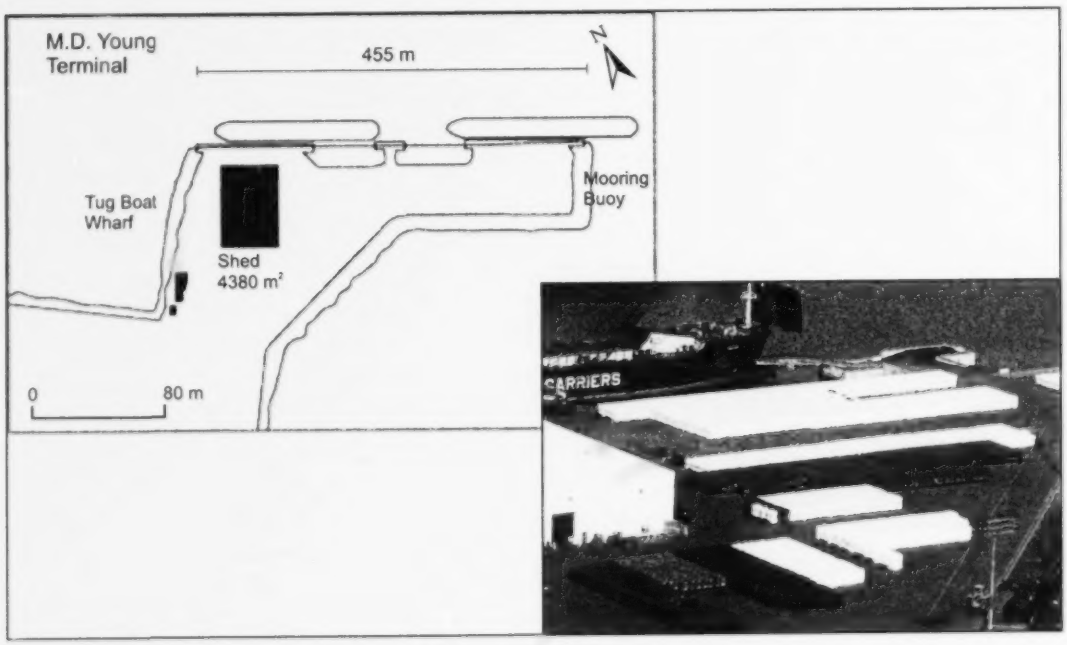


Figure 19. Layout of the M.D. Young Terminal at the Port of Belledune, northern New Brunswick.

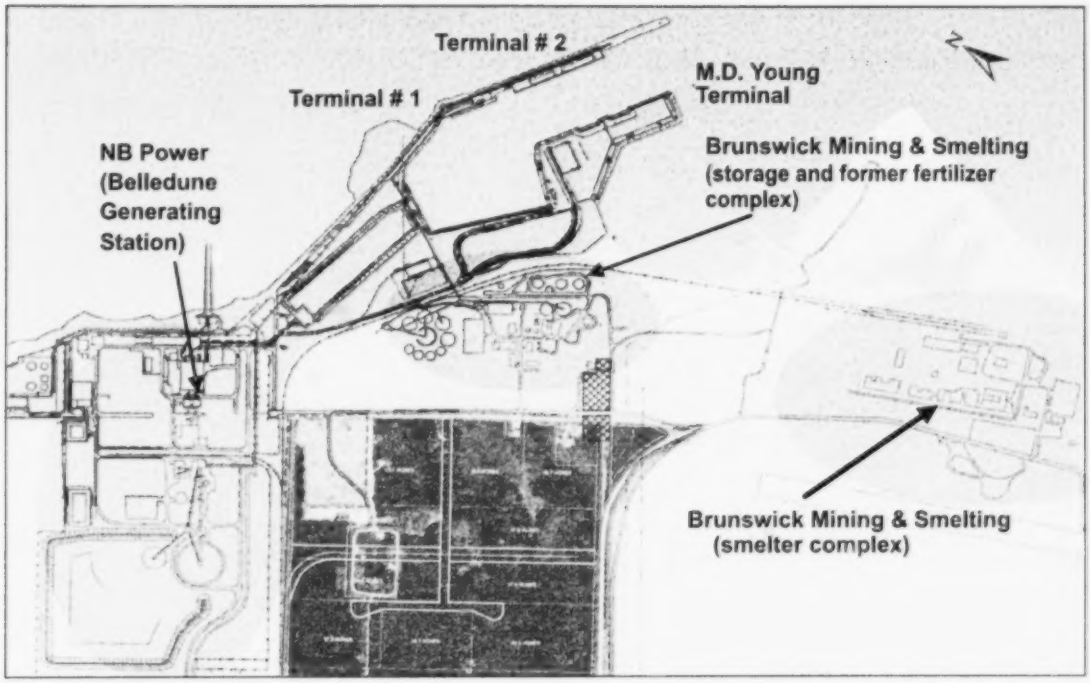


Figure 18. Plan view of the Port of Belledune, northern New Brunswick, showing position of main terminals and long-term clients.

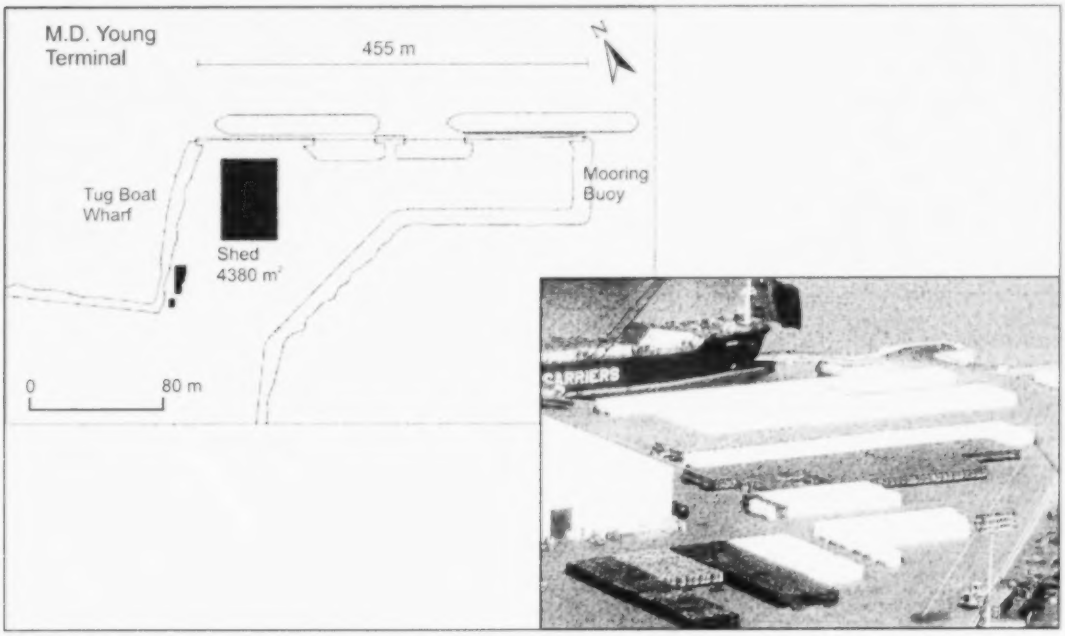
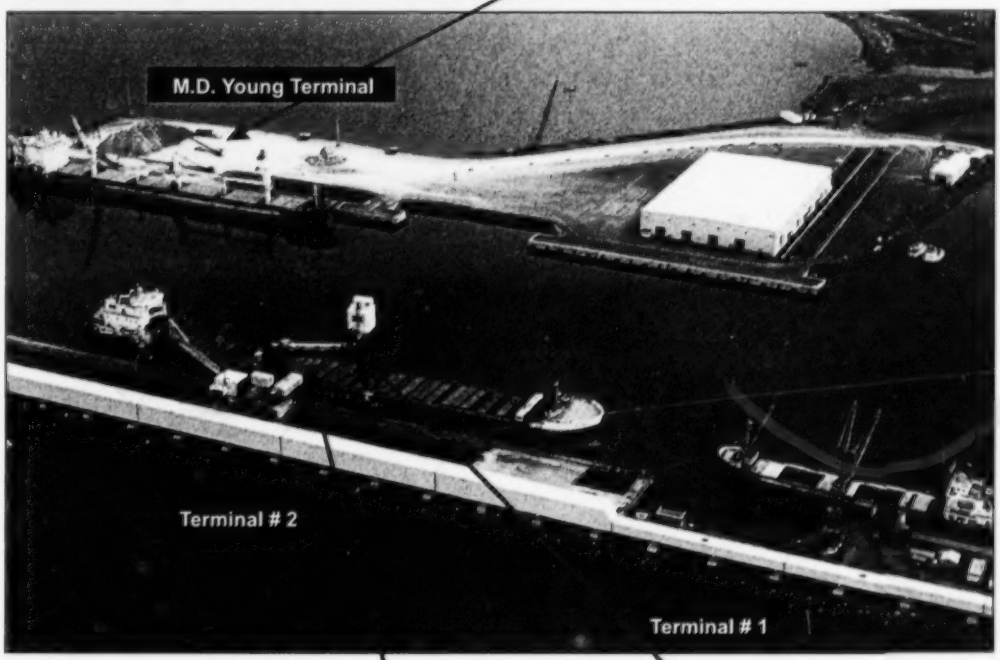


Figure 19. Layout of the M.D. Young Terminal at the Port of Belledune, northern New Brunswick.

Photograph to the left shows equipment loading 30 000 tonnes of pelletized gypsum at the M.D. Young Terminal, Port of Belledune, northern New Brunswick. Red arrow indicates photograph location, below.



Photographs to the right show the coal and petroleum coke offloading facility of NB Power at Terminal # 2, Port of Belledune, northern New Brunswick. The equipment can efficiently handle 60 000 tonne shipments. Red arrows indicate photograph location, above.

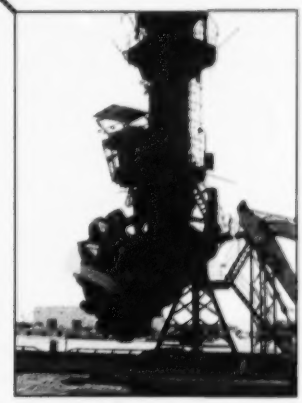


Figure 20. Overview of major terminals and loading and offloading equipment at the Port of Belledune, northern New Brunswick.

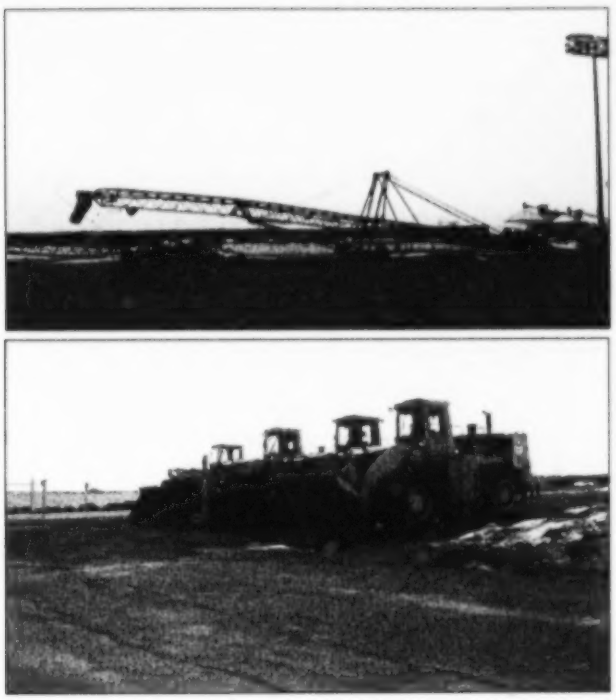


Figure 21. The Port of Belledune is well equipped to handle loadout assignments of bulk cargo in a timely and efficient manner.

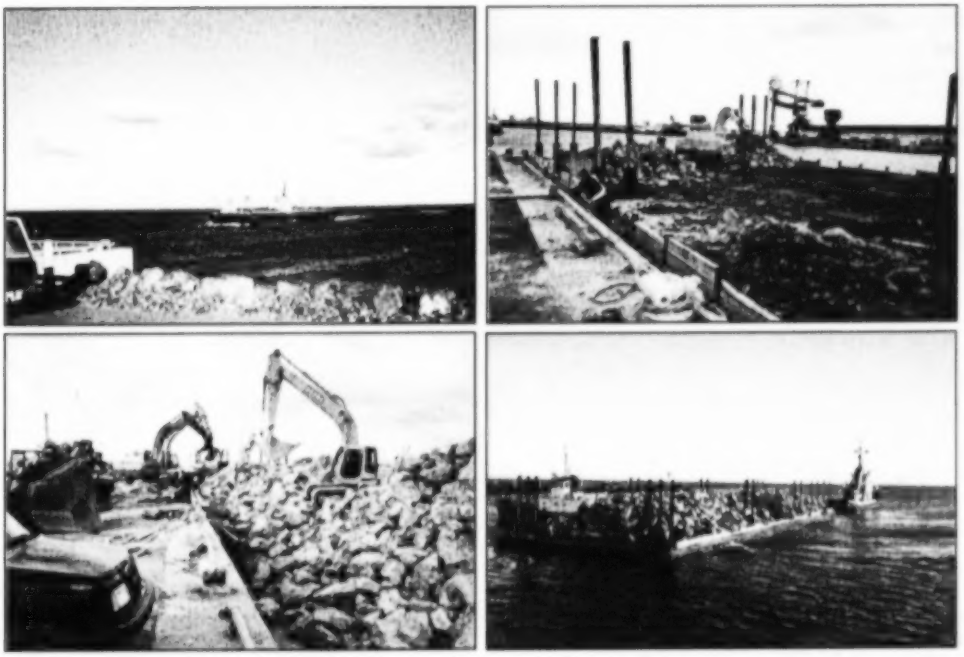


Figure 22. Arrival, loading, and departure of a 5000 tonne barge shipment of armour stone from the Port of Belledune, northern New Brunswick.

Regional Infrastructure and Support Services

Major highway and rail systems link both the currently active aggregate quarries and the potential aggregate resource area to the Port of Belledune. The New Brunswick East Coast Railway is a short-line railroad serving the Chaleur region. The railroad transects the northern part of the Elmtree Inlier, accesses the Belledune port facility, and from there connects with major transcontinental rail networks. Opportunities thus exist for the movement of aggregate materials to market destinations throughout eastern North America by rail as well as by ship.

The industrial environment of the Chaleur Economic Development Region is compatible with the production and export of high-quality aggregate materials from the Belledune area. Industrial support services and a workforce experienced in mining and related resource sectors already exist in the region. The district features a range of heavy industries including a smelter complex, a large lumber processing mill, and a major coal-fired power-generating station.

SUMMARY AND CONCLUSIONS

The demand for high-quality aggregate materials along the eastern seaboard and Gulf coast of North America has recently expanded and now exceeds the supply capabilities of domestic aggregate sources in the eastern United States. Projected population growth and the corresponding pressure on existing infrastructures in these areas will continue to challenge American suppliers of affordable, high-quality construction aggregate materials.

The Belledune area in northern New Brunswick offers the following key advantages to parties interested in developing a new aggregate export operation to serve the expanding international aggregate market.

- *High-quality aggregate materials situated near tidewater.* Basaltic and gabbroic rocks of the Fournier Group underlie about 75 km^2 in the Belledune area and offer an ideal source of high-quality construction aggregate. The rocks demonstrably possess rock engineering properties that meet or exceed minimum requirements for a wide range of construction applications. A sizeable tonnage of these potential aggregate materials lies within 10 km of the Port, the closest suitable outcrops being only 2 km from port facilities. Three quarry operations currently are active in the Belledune area, supplying crushed aggregate from rocks of the Fournier Group to local and regional markets in northern New Brunswick.

- *Ready access to aggregate resource.* Most aggregate resources near the Port of Belledune are remote from populated areas, decreasing the likelihood of land-use conflicts. About half of the aggregate resources are situated on Crown land, which is managed by the Province of New Brunswick.

- *Transparent regulatory procedures.* Land allocation procedures to permit quarry development on Crown land are well defined under the provincial Quarriable Substances Act, and an appropriate environmental regulatory process is in place.

- *Strategic position relative to offshore markets.* The Belledune area is well connected to global markets by marine and rail transportation networks. Most bedrock aggregate resources in the district are situated very near the Port, a factor that will be crucial for future aggregate enterprises in the district, particularly those targeting the eastern seaboard export market.

- *Modern port facilities and compatible regional infrastructure in an industrial setting.* The Port of Belledune is a fully serviced, year-round, deep-water facility with a proven ability to handle, store, and load large-tonnage granular bulk cargos in a timely and efficient manner. The industrial environment of the Chaleur Economic Development Region is compatible with the production and export of high-quality aggregate materials from the area. The region is supported by many mining-related service industries and a workforce experienced in mining and related resource sectors.

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APPENDIX 1: ENGINEERING TEST DATA

Tables 3 to 10 summarize engineering test data and some whole rock geochemical data for rock samples from the Fournier Group near the Port of Belledune in northern New Brunswick. All samples sites are situated in Gloucester County on NTS Map Sheet 21 P/13 and are plotted on Figure 2.

Samples listed in Tables 3 to 5 come from the three currently active bedrock aggregate quarries in the Belledune area. The quarry locations are shown on Figures 2 and 11. Data in the tables were provided by officials with Atcon Construction Ltd., the Blanchard Group, and Roy's Trucking & Landscaping Ltd. Samples in Tables 6 to 10 were collected by staff with the New Brunswick Department of Natural Resources.

Table 3. Engineering test data from the Belledune quarry of the Blanchard Group (formerly Blanchard Ready Mix Ltd.) showing results of coarse aggregate tests for Portland cement concrete. The data present a cumulate of individual samples collected over several days of production.

Sample Data	Sample Number and Rock Type	BL-02 (basalt)	BL-03 (basalt)	BL-05 (basalt)
	Year Sampled	2002	2003	2005
Location Data	UTM Coordinates (Zone 20)	287450E 5305000N	287450E 5305000N	287450E 5305000N
	Longitude/Latitude	-65° 49 43" 47° 52' 31"	-65° 49 43" 47° 52' 31"	-65° 49 43" 47° 52' 31"
Mechanical Data	Sieve Analysis *(CSA A23.2-2A)*	*Sieve Size (mm) / % Passing (avg)*: 28.0 / 100.0; 20.0 / 97.5; 14.0 / 71.0; 10.0 / 38.8; 5.0 / 3.2; 2.5 / 1.3; 0.080 / 0.42	*Sieve Size (mm) / % Passing (avg)*: 28.0 / 100.0; 20.0 / 99.2; 14.0 / 73.8; 10.0 / 34.4; 5.0 / 1.4; 2.5 / 0.7; 0.080 / 0.3	*Sieve Size (mm) / % Passing (avg)*: 28.0 / 100.0; 20.0 / 99.6; 14.0 / 76.8; 10.0 / 37.2; 5.0 / 1.7; 2.5 / 0.5; 0.080 / 0.1
Physical Data	Los Angeles Abrasion % Loss *(CSA A23.2-29A)*	10.2	10.8	10.3
	Micro-Deval % Loss *(CSA A23.2-29A)*	7.8	6.1	5.95
	Mg_2SO_4 Soundness % Loss *(CSA A23.2-9A)*	1.78	2.27	1.39
	Na_2SO_4 Soundness % Loss *(ASTM C131)*	n/a	n/a	n/a
	Absorption % *(CSA A23.2-12A)*	0.84	0.08	0.78
	Relative Density (SSD) *(CSA A23.2-12A)*	2.820	2.850	2.781
	Dry Density (kg/m^3) *(CSA A23.2-10A)*	1631.7	1636.5	1585.9
	Low Density Material % *(CSA A23.2-3A)*	0.0	0.0	n/a
	Unconfined Freeze-Thaw % Loss *(CSA A23.2-24A)*	1.1	1.40	0.88
	Flat & Elongated Particles % *(CSA A23.2-13A)*	2.1	1.5	2.70
	Finer than .080 mm Maximum % *(CSA A23.2-3A)*	0.4	0.3	0.1

Table 4. Engineering test data from the Belledune quarry of the Blanchard Group. Data show results of coarse aggregate tests for asphalt paving, based on stringent requirements of the New Brunswick Department of Transport for Type 1 Highways. The data present a cumulate of individual samples representing material collected over several days of production.

Sample Data	**Sample Number and Rock Type**	**BL-02 (basalt)**	**BL-03 (basalt)**	**BL-05 (basalt)**
	Year Sampled	2002	2003	2005
Location Data	UTM Coordinates (Zone 20)	287450E 5305000N	287450E 5305000N	287450E 5305000N
	Longitude/Latitude	-65° 49 43" 47° 52' 31"	-65° 49 43" 47° 52' 31"	-65° 49 43" 47° 52' 31"
Physical Data	Petrographic Number Maximum *(MTO LS 609)*	115	120	118
	Crushed Particles: Minimum %, one face *(MTO LS 607)*	100	100	100
	Crushed Particles: Minimum %, two face *(MTO LS 617)*	100	100	100
	Flat and Elongated Particles: Maximum % @ 4:1 *(MTO LS 608)*	3.1	3.27	2.8
	Micro-Deval Maximum % Loss *(MTO LS 618)*	8.3	6.75	8.12
	Freeze-Thaw Maximum % Loss *(MTO LS 614)*	1.8	0.91	1.18
	Absorption Maximum % *(ASTM C127)*	0.84	0.75	0.79
	Bulk Specific Gravity - dry *(ASTM C127)*	n/a	2.825	n/a
	Finer than 0.075 mm Maximum % *(ASTM C117)*	n/a	0.4	n/a

Table 5. Engineering test data from the Roy's Trucking & Landscaping Ltd. and Atcon Construction Inc. quarries in Belledune (quarry locations are shown on Fig. 2 and 11).

Sample Data	Sample Number and Rock Type	R-A-97 (basalt) Roy's Trucking	R-B-97 (basalt) Roy's Trucking	R-D-97 (basalt) Roy's Trucking	AT-2-03 ** Atcon
	Year Sampled	1997	1997	1997	2003
Location Data	UTM Coordinates (Zone 20)	285400E 5306700N	285400E 5306700N	285400E 5306700N	284400E 5307700N
	Longitude/Latitude	-65° 52' 26" 47° 52" 36"	-65° 52' 26" 47° 52" 36"	-65° 52' 26" 47° 52" 36"	-65° 52' 50" 47° 52" 57"
Mechanical Data	Coarse Aggregate Sieve Analysis *(CSA A23.2-2A or ASTM C117)* **Sieve fractions:** R-A-97 12.5–4.75 mm R-B-97 16–4.75 mm R-D-97 25–6.3 mm AT-2-03 20 mm	***Sieve Size %Passing*** *(mm)* *(avg)* 28.0 -- 20.0 -- 14.0 100 10.0 89 5.0 7 2.5 2 0.080 0.7	***Sieve Size %Passing*** *(mm)* *(avg)* 28.0 -- 20.0 100 14.0 77 10.0 40 5.0 7 2.5 2 0.080 1.0	***Sieve Size %Passing*** *(mm)* *(avg)* 19.0 100.0 12.5 70.7 9.5 39.6 6.3 15.8 4.75 8.4 2.36 1.9 1.18 1.6 0.600 1.4 0.300 1.3 0.150 1.1 0.075 0.9	***Sieve Size %Passing*** *(mm)* *(avg)* 28.0 100.0 20.0 99.3 14.0 73.2 10.0 46.7 5.0 2.9 2.5 1.0 1.25 0.9 0.630 0.8 0.315 0.8 0.160 0.7 0.080 0.6
Physical Data	Los Angeles Abrasion % Loss *(CSA A23.2-16A)*	5.6	14.1	14.7	13.3
	Micro-Deval % Loss *(CSA A23.2-29A)*	n/a	7.2	8.0	n/a
	Mg_2SO_4 Soundness % Loss *(CSA A23.2-9A)*	n/a	1.89	n/a	9.51
	Na_2SO_4 Soundness % Loss *(ASTM C88)*	0.32	0.57	0.16	n/a
	Finer than 0.080 mm Maximum % *(CSA A23.2-2A)*	0.7	0.7	n/a	0.6
	Finer than 0.075 mm Maximum % *(ASTM C117)*	n/a	n/a	0.9	n/a

** The rock type for this sample is not available. The Atcon Construction Ltd. quarry contains light to dark grey pillow basalt and basaltic breccia interbedded with fine-grained sedimentary clastic rocks and minor limestone.

Table 6. Engineering test data for samples collected in 1989 by staff with the New Brunswick Department of Natural Resources.

Sample Data	Sample Number and Rock Type	BR-67-89 (gabbro)	BR-68-89 (basalt)	BR-69-89 (basalt)	BR-71-89 (conglomerate)	BR-78-89 (basalt)	BR-79-89 (gabbro)
	Year Sampled	1989	1989	1989	1989	1989	1989
Location Data	UTM Coordinates (Zone 20)	292450E 5302800N	285850E 5306300N	276800E 5298200N	286900E 5309350N	285350E 5305000N	289100E 5301450N
	Longitude/Latitude	-65° 46' 21" 47° 50' 44"	-65° 51'51" 47° 52' 32"	-65° 52' 19" 47° 51' 37"	-65° 50' 51" 47° 54' 11"	-65° 52' 05" 47° 51' 49"	-65° 48' 44" 47 °49' 50"
Mechanical Data *(ASTM C117)*	% Gravel (> 4.75 mm)	86.0	80.7	85.0	81.4	81.8	81.7
	% Sand (> 75 um–4.75 mm)	12.8	18.0	14.0	16.9	17.1	16.9
	% Fines (< 75 um)	1.2	1.3	1.0	1.7	1.1	1.4
Physical Data	Los Angeles Abrasion % Loss *(ASTM C117)*	11.3	11.3	12.5	17.6	10.9	11.0
	Na_2SO_4 Soundness % Loss *(ASTM C131)*	0.7	0.69	0.53	0.69	0.22	0.23
	Absorption % *(ASTM C127)*	0.65	0.92	0.58	2.02	0.73	0.39
	Bulk Specific Gravity - wet *(ASTM C127)*	2.873	2.804	2.841	2.591	2.853	2.920
	Bulk Specific Gravity - dry *(ASTM C127)*	2.855	2.779	2.824	2.504	2.832	2.908
	Apparent Specific Gravity *(ASTM C127)*	2.909	2.582	2.871	2.677	2.892	2.942
	Unconfined Freeze-Thaw % Loss *(CSA A23.2-24A)*	n/a	n/a	n/a	n/a	n/a	n/a
	Flat & Elongated Particles % *(CSA A23.2-13A)*	n/a	n/a	n/a	n/a	n/a	n/a
	Finer than .075 mm Maximum % *(ASTM C117)*	1.2	1.3	1.0	1.7	1.1	1.4

Table 7. Engineering test data for samples collected in 2003 by staff with the New Brunswick Department of Natural Resources.

Sample Data	Sample Number and Rock Type	DMVB-01-03 (basalt)	DBPB-02-03 (gabbro)	DBPB-02A-03 (gabbro)	LVB-06-03 (limestone)
	Year Sampled	2003	2003	2003	2003
Location Data	UTM Coordinates (Zone 20)	287450E 5304250N	288900E 5302500N	288400E 5303550N	284800E 5308250N
	Longitude/Latitude	-65° 50' 29" 47° 51' 24"	-65° 49'12" 47° 50' 27"	-65° 49' 39" 47° 50' 57"	-65° 51 57" 47° 53' 17"
Mechanical Data *(ASTM C117)*	% Gravel (> 4.75 mm)	83	84	81	81.0
	% Sand (> 75 um–4.75 mm)	15.8	13.5	17.2	17.9
	% Fines (< 75 um)	1.2	2.5	1.8	1.1
Physical Data	Los Angeles Abrasion % Loss *(ASTM C117)*	8.7	10.5	12.5	25.9
	Micro-Deval % Loss *(CSA A23.2-29A)*	3.5	2.9	4.4	14.0
	Mg_2SO_4 Soundness % Loss *(ASTM C88)*	0.24	0.16	0.25	2.90
	Absorption % *(ASTM C127)*	0.27	0.28	0.35	0.70
	Bulk Specific Gravity - wet *(ASTM C127)*	2.953	2.890	2.913	2.688
	Bulk Specific Gravity - dry *(ASTM C127)*	2.945	2.882	2.903	2.669
	Unconfined Freeze Thaw % Loss *(CSA A23.2-24A)*	0.1	1.14	0.93	20.46
	Flat & Elongated Particles % *(CSA A23.2-13A)*	2.2	2.1	2.7	4.3
	Finer than .075 mm Maximum % *(ASTM C117)*	1.2	2.5	1.8	1.1

Table 8. Whole rock analyses for samples listed in Table 5.

Sample Data	Sample Number and Rock Type	DMVB-01-03 (basalt)	DBPB-02-03 (gabbro)	DBPB-02A-03 (gabbro)	LVB-06-03 (limestone)
	Year Sampled	2003	2003	2003	2003
Location Data	UTM Coordinates (Zone 20)	287450E 5304250N	288900E 5302500N	288400E 5303550N	284800E 5308250N
	Longitude/Latitude	-65° 50' 29" 47° 51' 24"	-65° 49'12" 47° 50' 27"	-65° 49' 39" 47° 50' 57"	-65° 51 57" 47° 53' 17"
Whole Rock Analysis (XRF)	Al_2O_3	13.68	17.07	18.87	0.63
	CaO	7.3	14.21	13.27	52.21
	Fe_2O_3	14.66	7.38	6.24	0.73
	K_2O	0.11	0.11	0.17	0.05
	MgO	6.02	8.93	7.34	0.88
	MnO	0.234	0.137	0.106	0.047
	Na_2O	4.65	1.61	2.43	0.05
	P_2O_5	0.16	0.02	0.05	0.02
	SiO_2	49.54	48.81	50.02	2.90
	TiO_2	1.9	0.43	0.5	0.070
	LOI (loss on ignition)	1.83	0.96	1.97	41.50
	SUM	100.08	99.67	100.96	99.08

Table 9. Engineering test data for samples collected in 2005 by staff with the New Brunswick Department of Natural Resources.

Sample Data	Sample Number and Rock Type	BEL-B-B1-05 (basalt)	BEL-C-G6-05 (basalt)	BEL-D-G4-05 (gabbro)	BEL-G-G5-05 (gabbro)
	Year Sampled	2005	2005	2005	2005
Location Data	UTM Coordinates (Zone 20)	285678E 5304835N	292272E 5303671N	284939E 5301745N	288293E 5301250N
	Longitude/Latitude	-65° 51' 56" 47° 51' 40"	-65° 46' 37" 47° 51' 10"	-65° 52' 26" 47° 49' 59"	-65° 49' 44" 47° 49' 47"
Mechanical Data *(ASTM C117)*	% Gravel (> 4.75 mm)	77.0	83.0	80.0	83.5
	% Sand (> 75 um–4.75 mm)	21.5	15.3	17.6	14.5
	% Fines (< 75 um)	1.5	1.7	2.4	2.0
Physical Data	Los Angeles Abrasion % Loss *(ASTM C117)*	11.1	15.5	11.1	10.6
	Micro-Deval % Loss *(CSA A23.2-29A)*	4.3	4.3	6.4	5.7
	Mg_2SO_4 Soundness % Loss *(ASTM C88)*	0.22	0.29	1.24	0.78
	Absorption % *(ASTM C127)*	0.41	0.63	1.02	0.97
	Bulk Specific Gravity - wet *(ASTM C127)*	2.770	2.937	2.906	2.938
	Bulk Specific Gravity - dry *(ASTM C127)*	2.759	2.919	2.877	2.909
	Unconfined Freeze Thaw % Loss *(CSA A23.2-24A)*	1.26	1.44	1.64	1.37
	Finer than .075 mm Maximum % *(ASTM C117)*	1.5	1.7	2.4	2.0
	Accelerated Mortar Bar Test *(ASTM C1260)*	% Expansion 14 days: 0.2259 28 days: 0.5169	% Expansion 14 days: 0.1232 28 days: 0.2980	% Expansion 14 days: 0.0782 28 days: 0.1906	% Expansion 14 days: 0.0680 28 days: 0.1531

Table 9 (continued). Engineering test data for samples collected in 2005 by staff with the New Brunswick Department of Natural Resources.

Sample Data	Sample Number and Rock Type	BEL-K-G3-05 (basalt)	BEL-L-G2-05 (gabbro)	BEL-M-G1-05 (gabbro)
	Year Sampled	2005	2005	2005
Location Data	UTM Coordinates (Zone 20)	285678E 5304835N	288477E 5303438N	289003E 5302460N
	Longitude/Latitude	-65° 50' 06" 47° 51' 15"	-65° 49' 39" 47° 50' 58"	-65° 49' 12" 47° 50' 27"
Mechanical Data *(ASTM C117)*	% Gravel (> 4.75 mm)	85.5	83.0	88.0
	% Sand (> 75 um–4.75 mm)	13.4	14.8	9.8
	% Fines (< 75 um)	1.1	2.2	2.2
Physical Data	Los Angeles Abrasion % Loss *(ASTM C117)*	8.5	10.9	15.5
	Micro-Deval % Loss *(CSA A23.2-29A)*	3.0	3.5	6.8
	Mg_2SO_4 Soundness % Loss *(ASTM C88)*	0.18	0.17	0.37
	Absorption % *(ASTM C127)*	0.39	0.44	0.65
	Bulk Specific Gravity - wet *(ASTM C127)*	2.989	2.937	2.924
	Bulk Specific Gravity - dry *(ASTM C127)*	2.978	2.924	2.905
	Unconfined Freeze Thaw % Loss *(CSA A23.2-24A)*	1.48	0.85	0.95
	Finer than .075 mm % *(ASTM C117)*	1.1	2.2	2.2
	Accelerated Mortar Bar Test *(ASTM C1260)*	% Expansion 14 days: 0.1400 28 days: 0.3323	% Expansion 14 days: 0.0041 28 days: 0.0072	% Expansion 14 days: 0.1324 28 days: 0.2214

Table 10. Whole rock analyses for samples listed in Table 9.

Sample Data	Sample Number and Rock Type	BEL-B-B1-05 (basalt)	BEL-C-G6-05 (basalt)	BEL-D-G4-05 (gabbro)	BEL-G-G5-05 (gabbro)
	Year Sampled	2005	2005	2005	2005
Location Data	UTM Coordinates (Zone 20)	285678E 5304835N	292272E 5303671N	284939E 5301745N	288293E 5301250N
	Longitude/Latitude	-65° 51' 56" 47° 51' 40"	-65° 46' 37" 47° 51' 10"	-65° 52' 26" 47° 49' 59"	-65° 49' 44" 47° 49' 47"
Whole Rock Analysis (XRF)	Al_2O_3	12.47	14.67	15.27	17.36
	CaO	5.02	6.99	9.31	11.56
	Fe_2O_3	9.26	11.63	12.27	9.14
	K_2O	0.48	0.2	0.32	0.37
	MgO	2.91	3.04	5.89	7.54
	MnO	0.146	0.11	0.199	0.141
	Na_2O	3.6	3.36	3.18	2.36
	P_2O_5	0.73	0.36	0.49	0.15
	SiO_2	58.68	55.66	48.26	48.08
	TiO_2	1.46	1.45	2.47	0.54
	LOI (loss on ignition)	4.52	2.23	2.16	2.26
	SUM	99.27	99.69	99.83	99.54

Table 10 (continued). Whole rock analyses for samples listed in Table 9.

Sample Data	Sample Number and Rock Type	BEL-K-G3-05 (basalt)	BEL-L-G2-05 (gabbro)	BEL-M-G1-05 (gabbro)
	Year Sampled	2005	2005	2005
Location Data	UTM Coordinates (Zone 20)	285678E 5304835N	288477E 5303438N	289003E 5302460N
	Longitude/Latitude	-65° 50' 06" 47° 51' 15"	-65° 49' 39" 47° 50' 58"	-65° 49' 12" 47° 50' 27"
Whole Rock Analysis (XRF)	Al_2O_3	15.97	17.68	18.31
	CaO	10.55	13.26	14.24
	Fe_2O_3	11.94	6.93	5.56
	K_2O	0.16	0.12	0.31
	MgO	7.46	8.75	9.64
	MnO	0.186	0.128	0.087
	Na_2O	2.15	1.86	1.36
	P_2O_5	0.1	0.01	0.01
	SiO_2	48.1	48.25	47.39
	TiO_2	1.14	0.37	0.23
	LOI (loss on ignition)	1.61	2.36	2.06
	SUM	99.43	99.74	99.31

APPENDIX 2: ACQUISITION OF CROWN LAND PIT AND QUARRY RIGHTS

The Minister of the New Brunswick Department of Natural Resources (NBDNR) controls the extraction of all quarriable substance in New Brunswick (i.e. granular and bedrock aggregate, and peat) on Crown land, as outlined in the Quarriable Substances Act and Regulation 93-92.

Crown land aggregate materials may be acquired in New Brunswick by means of three regulated procedures: written authorization, quarry permit, and quarry lease.

1. Written Authorization

Written authorization applies to extraction from existing pits or quarries for tonnages of less than 1000 tonnes for a period not exceeding 30 days.

1. Application is made at the local District Ranger Office. The application fee is $10.00, as per Regulation 93-92 (2003).
2. If approved, the District Ranger can issue authorization on the same day. The applicant is required to pay a nonrefundable royalty payment. The royalty payment is calculated at 25 cents/tonne, as per regulation 93-92 (2003), on the total amount of material required (< 1000 tonnes) at the time of issue.
3. The applicant has 30 days from the authorization date to extract the required material. The authorization expires after that time. If the material has not been extracted during this period, the applicant will be required to re-apply (note: royalty payments are not refundable).

2. Quarry Permit

A quarry permit addresses extraction from new or existing pits or quarries for a period ending December 31st of the same year in which the permit was issued.

1. Application is made at the local District Ranger Office. The application fee is $10.00, as per Regulation 93-92 (2003).
2. Application is reviewed by the District Ranger, by officials at the Regional Office, and by the NBDNR Mines Branch. The process takes about two weeks.
3. Once approved, the quarry permit is valid for the time specified, but in no case shall it exceed December 31st of the year for which it is issued.
4. The permittee is required to submit a royalty payment and a royalty return form stating quantities of quarriable substances removed. The royalty payment is calculated at 25 cents/tonne, as per regulation 93-92 (2003). It must be paid to the Financial Services Branch of the NBDNR before July 20th and January 20th.

Depending on circumstances, various conditions may apply to the authorization and quarry permit concerning development, operation, and reclamation of the subject pit or quarry site.

Development

1. No material is to be removed from within 60 m of any watercourse.
2. No material is to be removed from below the water table.
3. All merchantable timber must be harvested before any material is removed. Proper permits must be in place before harvesting operations are initiated.
4. Any overburden removed during stripping operations must be stored at a site approved by the District Ranger to be used for reclamation initiatives (i.e. revegetation) following completion of the extractive phase of operations. In other words, the permittee is required to redistribute overburden over the excavated area once operations are complete, if the District Ranger deems it necessary.

Operation

1. Should any water be withdrawn from nearby watercourses for the operation of pits or quarries, or should any water be discharged from a pit or quarry operation, appropriate approvals (i.e. a Watercourse Alteration Permit) are required from the Department of Environment and Local Government.
2. Any stream crossing or alteration associated with pit and quarry operations will require appropriate approvals (i.e. a Watercourse Alteration Permit) from the Department of Environment and Local Government.
3. If an operator plans on conducting any kind of processing facility in conjunction with pit and quarry operations (i.e. for asphalt, cement, etc.), they may require a Certificate of Approval to Operate issued by the Department of Environment and Local Government.
4. Operators should be aware that the Workplace, Health and Safety Compensation Commission have regulations addressing the safe operation of equipment in a pit or quarry.

Reclamation

All permit holders are required to rehabilitate the area they have worked, within a Crown land pit or quarry. In general, the permit holder is required to take appropriate steps to ensure the safety of the public and protection of the environment. This includes, but is not limited to, sloping or placing safety berms around perimeters of worked faces and the proper contouring pit/quarry floors to limit excessive ponding of water within the excavated area. As well, there may be conditions added to the authorization or permit specifying certain requirements such as re-seeding and re-forestation for the worked area.

3. Quarry Lease

A quarry lease is the third procedure available to acquire the rights to Crown land quarriable substances. It differs from the authorization and permitting process in that a lease will provide a company with exclusive rights to a specified resource area and/or sole use of a pit or quarry

located on Crown land. The term of the lease can vary but can reach a maximum of ten years. To secure a quarry lease, the company must demonstrate the need for exclusive use (e.g. to secure their investment in equipment).

The quarry lease application and approval process generally requires a minimum of six months to complete and includes the following steps:

1. Application is made at the local District Ranger Office. The application fee is $50.00, as per Regulation 93-92 (2003).
2. The application is forwarded by the Regional Office to the NBDNR Mines Branch in Fredericton.
3. As part of a comprehensive review process, the applicant also is required to submit additional details pertaining to the development and reclamation of the proposed pit or quarry site. This information generally includes, but is not limited, to the following five plans. (Note: the Minister of Natural Resources reserves the authority to attach special conditions to any proposed Crown land pit/quarry authorization, permit, or lease.)

1. Location Plan

- Map (1:12 500 scale or greater detail) showing topographic features, natural watercourses, public roads and highways, and any surrounding or neighbouring land uses, etc., within 1000 m of the proposed pit or quarry site.
- Map showing the proposed lease boundaries, including the size of the lease area (in hectares).
- Site plan showing entrances and exits to and from the site; location of any fences, gates or barriers; location of all facilities associated with further processing, waste water treatment or control of surface water; production stockpile location(s), waste piles, settling ponds; and location of all permanent or temporary structures on the site.

2. Development Plan

- An estimate of annual production, employment potential, proposed extraction method(s), provisions for safety, planned sequence, and direction of pit development.
- Estimated investment in equipment to be used including that associated with drilling, blasting, loading, hauling and sizing, and a list of commodities (i.e. products) to be produced.

3. Operating Plan

- Annual operating schedule, including daily hours of operation.
- Haulage routes to be used to transport product to customers.
- A description of the source, quantity, and use of water in the extraction or beneficiation process (i.e. wash plant, etc.).

4. Environmental Protection Plan

- A description of the method(s) used to collect, store, and dispose of lubricants.
- A list of chemicals to be used on site.
- A description of the quantity, quality, and mitigative processes proposed to treat any effluent being discharged into the surrounding environment.

5. Reclamation Plan

- A detailed description and schedule of the planned procedures for the protection, reclamation, and rehabilitation of the site, including where applicable details pertaining to backfilling, contouring, benching, sloping, grading, fencing, screening, construction of berms, and revegetation.
- A plan for ongoing reclamation and an estimated cost of the reclamation program.

The foregoing information is reviewed by various regulatory agencies. Comments are coordinated and reviewed by Mines Branch officials when considering the application. On approval, the lease applicant is required to proceed with a legal survey of the proposed site and submit an appropriate survey plan. The applicant is required to pay a first-year land rental fee, calculated at $50/ha, as per regulation 93-92 (2003). The applicant also must submit a reclamation security calculated at $20/ha or $5000.00, whichever is greater, as per regulation 93-92 (2003). When all requirements are completed, the lease documents are prepared for signature by the lessee and the Minister.

As with the permitting process, the leaseholder is required to submit a royalty payment and a royalty return form stating quantities of quarriable substances removed. The royalty payment is calculated at 25 cents/tonne, as per regulation 93-92 (2003), and must be paid to the Financial Services Branch of the NBDNR before July 20th and January 20th.

APPENDIX 3: SELECTED BUSINESS AND GOVERNMENT CONTACTS

The following contacts can provide additional information regarding potential opportunities for the export of high-quality bedrock aggregate materials from the Port of Belledune, northern New Brunswick. Listed below are contact links for information concerning 1) established quarry operations in the region, 2) port and rail services, 3) resource and business development issues, and 4) acquisition of maps, air photographs, and property information.

Established Bedrock Aggregate Quarries

Rob Hems, Atcon Construction Inc.
626 Newcastle Boulevard
Miramichi, NB
Canada E1V 2L3
Telephone: (506) 627-1222 or (506) 450-0232
E-mail: info@atcongroup.com
Website: www.atcongroup.com

Ron Arseneau, Blanchard Group
4586 Route 134
Allardville, NB
Canada E8L 1E2
Telephone: (506) 725-2132 or (888) 240-0020
E-mail: ronald@blanchardgroup.ca
Website: www.blanchardgroup.ca

Daniel Roy, Roy's Trucking & Landscaping Ltd.
236 rue Principale
CP 6506
Nigadoo, NB
Canada E8K 3S9
Telephone: (506) 783-3834

Port and Rail Services

Rayburn Doucett
President & Chief Executive Officer
Belledune Port Authority
112 Shannon Drive
Belledune, NB
Canada E8G 2W2
Telephone: (506) 522-1200
E-mail: doucett@portofbelledune.ca
Website: www.portofbelledune.ca

Donald A. Roy, Manager
Eastern Canada Stevedoring Inc.
261 Shannon Drive, Unit 2
Belledune, NB
Canada E8G 2W1
Telephone: (506) 522-1800
E-mail: droy@qsl.com
Website: www.qsl.com

Gilies Richard, General Manager
New Brunswick East Coast Railway
970 rue Principale
Beresford, NB
Canada E8K 2H6
Telephone: (506) 546-0921
E-Mail: gilles.richard@cfqc.com

Mineral Resource Characteristics, Crown Land Allocation, and Environmental Matters

Industrial Mineral Resources

Tim C. Webb, P. Geo
New Brunswick Department of Natural Resources
Minerals, Policy and Planning Division
Geological Surveys Branch
PO Box 6000
Fredericton, NB
Canada E3B 5H1
Telephone: (506) 453-2206
E-mail: Tim.Webb@gnb.ca

Serge Allard
New Brunswick Department of Natural Resources
Minerals, Policy and Planning Division
Geological Surveys Branch
PO Box 6000
Fredericton, NB
Canada E3B 5H1
Telephone: (506) 453-2206
E-mail: Serge.Allard@gnb.ca

Quarriable Substance Resource Management for Crown Land

Mitchell O'Donnell
New Brunswick Department of Natural Resources
Minerals, Policy and Planning Division
Minerals and Petroleum Development Branch
PO Box 6000
Fredericton, NB
Canada E3B 5H1
Telephone: (506) 453-2206
E-mail: Mitch.O'Donnell@gnb.ca

Mineral Resource Allocation (Prospecting and Staking)

Ron Shaw, Manager
New Brunswick Department of Natural Resources
Minerals, Policy and Planning Division
Minerals and Petroleum Development Branch
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Environmental Issues

Donald Grass, Manager
New Brunswick Department of Environment and Local Government
Environmental Management Division
Resource Sector Section
Marysville Place
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Business Development

Donald Hammond, Executive Director
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275 Main Street, Suite 212A
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Canada E2A 1A9
Telephone: (506) 547-7445
E-mail: donald.hammond@ent-chaleur.ca
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Property Information, Maps, and Air Photographs

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Registry and Mapping Services
City Centre
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Website: www.snb.ca